The Welding Engineer

Reg. U. S. Pat. Office

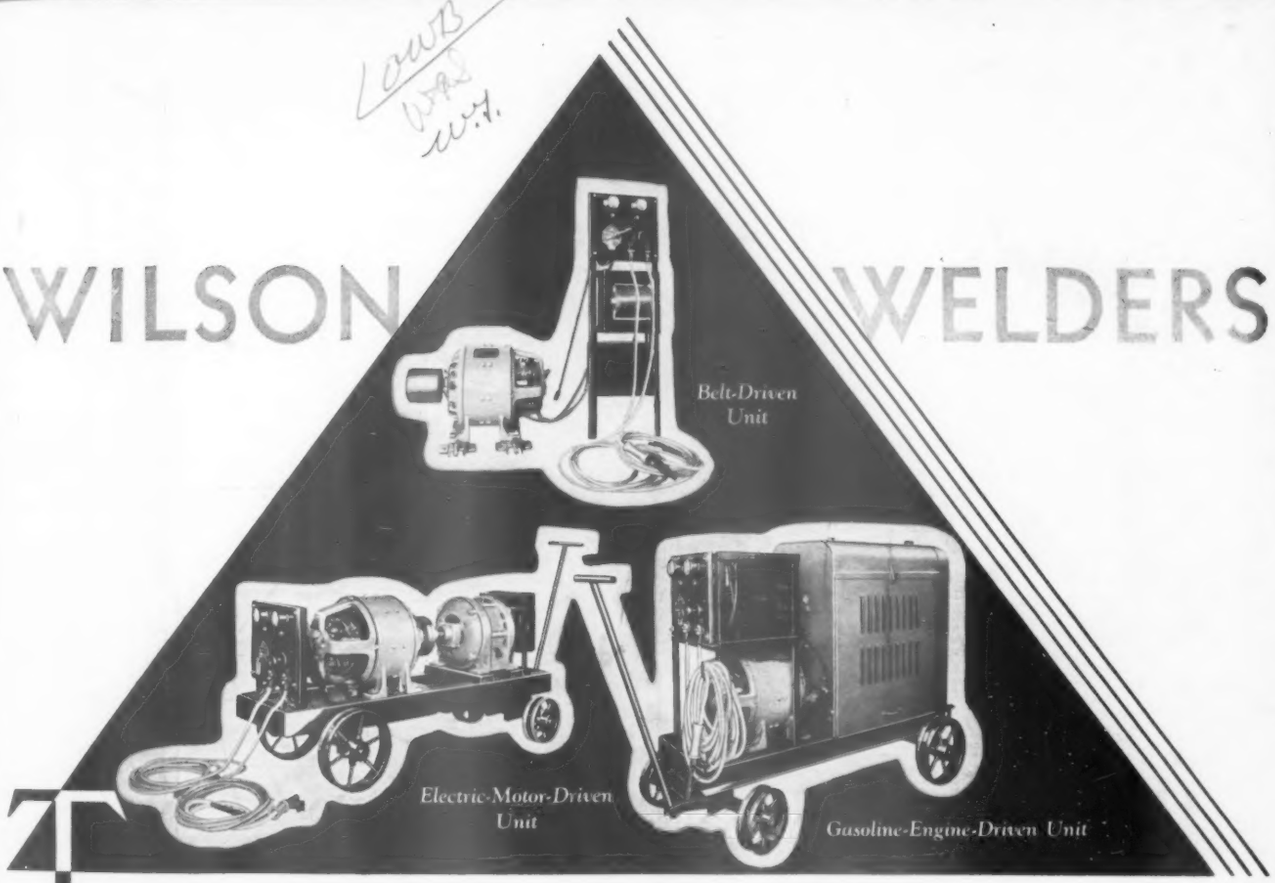
Founded by L. B. Mackenzie, 1916

WITH WHICH IS COMBINED ACETYLENE JOURNAL

$3.00 per year in U. S. | 608 S. Dearborn St., Chicago, Ill. | $4.00 per year abroad

MARCH, 1931 | VOL. 16, NO. 3

WILSON WELDERS



They *increase output* and *decrease outlay*

Only in Wilson Arc-Welding Machines can you obtain all of these features:

The arc is easy to strike and easy to maintain
The arc is uniform thruout the welding range
The arc is quickly adjusted from job to job
The generator is self-excited, and its commutator is always the coolest part of the machine

Whether you are already using arc-welding, or are yet to profit by its advantages, you should know all about Wilson Welders. Write today for illustrated bulletins.

WILSON WELDER & METALS CO. INC., 20 WILSON BUILDING, NORTH BERGEN, N. J.

WILSON

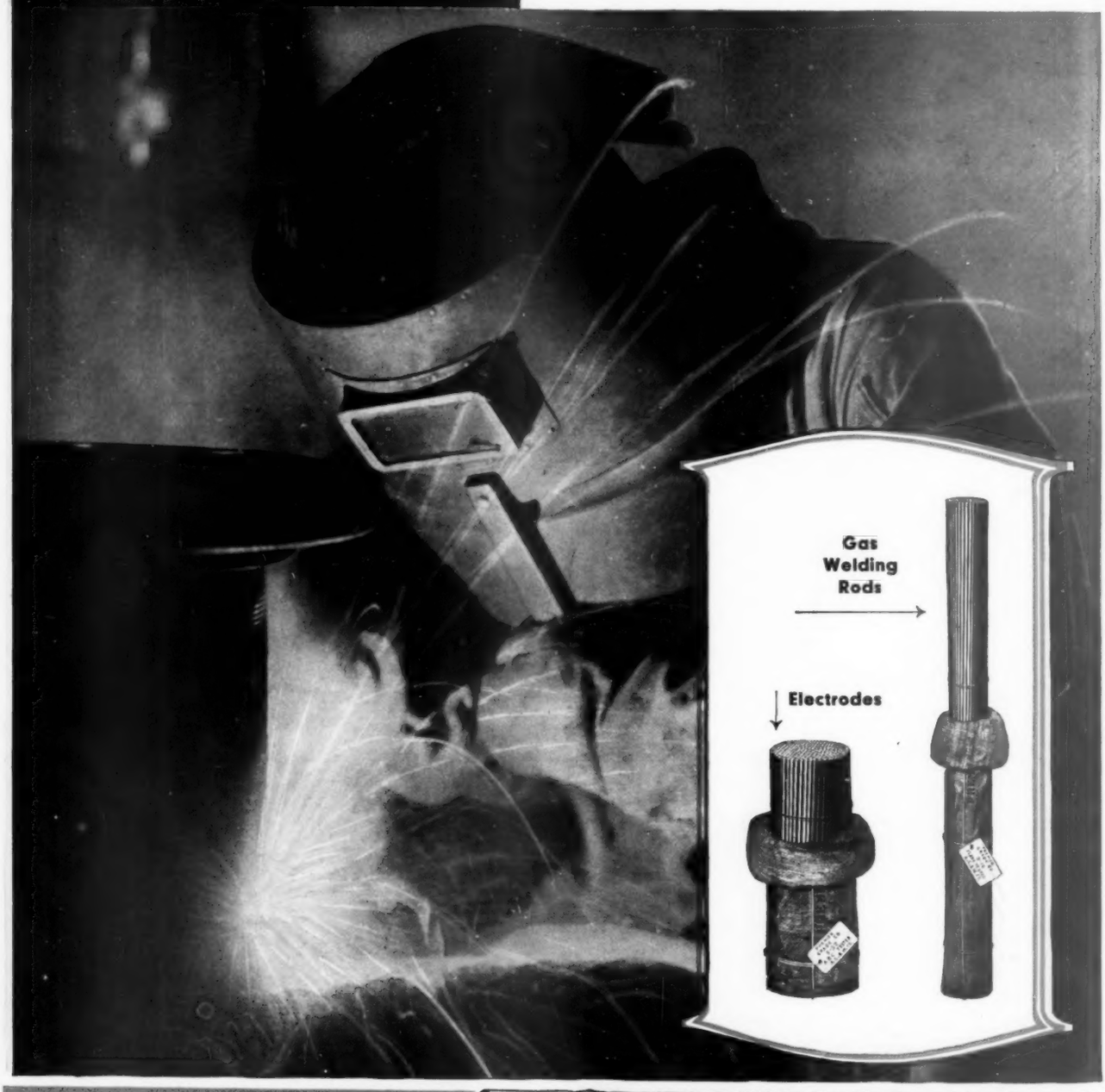
WELDING MACHINES AND WELDING WIRE

Published monthly by the Welding Engineer Publishing Co. Entered as second class matter Jan. 20, 1916, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

PREMIER
TESTED
Welding Wires

Superiority Proved by Service

Of equal importance to skill is the quality of Welding Wire. Good wire means perfect work, satisfied customers and lower shop costs. Premier Welding Wire is good wire—proved superior under all conditions of service—both electric and gas. Each bundle is shop tested to assure its uniform structure, free flowing and deeply penetrating qualities. Today, write us about your welding problems —no obligation.



1831 — COMMEMORATING AMERICAN STEEL & WIRE COMPANY 100 YEARS OF PROGRESS IN WIRE MAKING — 1931

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago — SUBSIDIARY OF UNITED STATES STEEL CORPORATION — And All Principal Cities

Pacific Coast Distributors: Columbia Steel Company, Russ Building, San Francisco

Export Distributors: United States Steel Products Company, New York

The Welding Engineer

Founded by L. B. Mackenzie, 1916

WITH WHICH IS COMBINED ACETYLENE JOURNAL

Volume 16 | March, 1931 | Number 3

CONTENTS

Hard-Facing in Industrial Fields 33
By W. A. Wissler and A. V. Harris
Arc Welding Broken Crank Shafts 36
Where the Gas Torch Pays Dividends 39
Welding a Skyscraper (Part II) 42
By F. P. McKibben
Oxy-Acetylene in Shipyard Work 46
By James W. Owens
Certifying Welds 49
By H. L. Whittemore
Hints for the Welder 53
Editorial 31
Continuous Welding of Spiral Pipe 41
"Flash" Butt Welding a Forging to Seamless Tubing 48
By W. F. Pravel
Hollow Steel Lumber 50
By W. O. Sheldon
Building a Job Welding Business 55
By W. Irving Brockson
Oil Equipment and Engineering Exposition 51
One Hundred Cities and Towns Have Adopted Welding 52
New Application of Welding in Oil Field Work 54
New Literature 58
New Products 59
News of the Industry 61

Quality as an Opportunity

AMONG all the industries which utilize the welding processes in production there is probably none more highly competitive than that of the tank makers. The tank industry is a fine example of the opportunity which exists to build business on the basis of quality rather than price. This will be stoutly denied by those who have not tried it, some of whom have really come to grief by meeting competition with cheap production. Several years ago a man broke into this highly competitive field and made high quality materials the foundation of his business. It worked and his business grew. Then he added the feature of a stronger weld instead of a cheaper one. The result was a further expansion. More recently he has gone in for heavier sheet and plate, higher in first cost, but lower in cost per year of service. And his business still grows. It is a sales plan based upon the demand which can be created for good workmanship. Good welding can be sold at a profit in markets where mediocre workmanship means at best a chance to swap dollars. It takes a more expensive sales set-up to market a quality product, just as it takes a more expensive production set-up to manufacture it, but the firms who have attended to both of these details are paying dividends.

Published on the 15th of Each Month by
THE WELDING ENGINEER PUBLISHING CO.
608 S. Dearborn St., Chicago, Ill.
Telephone WEBster 7134

G. H. Mackenzie ..... President and Treasurer
H. S. Card ..... Secretary

H. S. Card ..... Editor
M. S. Hendricks ..... Managing Editor

Eastern Office—222 American Circle Bldg., New York. T. E. DePew, Eastern Manager. Telephone, Columbus 7843

Subscription payable in advance and postage free.
United States and possessions and Canada ..... $3 a year
Foreign Countries ..... $4 a year
Single copy, domestic ..... 25 cents
Single copy, foreign ..... 30 cents

Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

The Welding Engineer is a member of the Audit Bureau of Circulations and of the Associated Business Papers, Inc.

Last Advertising forms close at 8:00 a. m. on the 12th. To show proof for correction copy must be received at an earlier date and allowances should be made for delay to mails. All copy should be in by the 12th of the month at the latest.

The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

Authorized Representatives

CLEVELAND—R. K. Randall, 2261 E. 14th St.
DENVER—A. G. Odell, Public Opportunity School.
GREAT BRITAIN—Capt. D. Richardson, 26 Winterbrook Road, Herne Hill, London.
AUSTRALIA AND NEW ZEALAND—R. Hill, Matlock House, Davenport, Auckland, New Zealand.
SOUTH AFRICA—J. W. Arnison, 35a Victoria Ave., Benoni, Transvaal, South Africa.

Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

ACETYLENE (Compressed in Cylinders)
Air Reduction Sales Co.
Commercial Acetylene Supply Co.
Linde Air Products Co.

ACETYLENE CYLINDERS
Pressed Steel Tank Co.

ACETYLENE WELDING WIRE
Air Reduction Sales Co.
American Brass Co.
American Steel & Wire Co.
Atlas Foundry Co.
Central Steel & Wire Co.
Fusion Welding Corporation
Haynes Stellite Co.
Hollup Corp.
Imperial Brass Mfg. Co.
Koro Corporation
Linde Air Products Co.
Page Steel & Wire Co.
Roebling, John A., Sons Co.
Joseph T. Ryerson & Son, Inc.
Seneca Wire Mfg. Co.
St. Paul Welding & Mfg. Co.
Steel Sales Corp.
Stoody Co.
Torchweld Equipment Co.
Weldit Acetylene Co.
Wickwire Spencer Steel Co.
Williams & Co.

ACID RESISTING ROD
Central Steel & Wire Co.
Fusion Welding Corporation
Haynes Stellite Co.
Hollup Corporation
Joseph T. Ryerson & Sons, Inc.
Steel Sales Corporation
Wilson Welding & Metals Co.

ALUMINO-THERMIC WELDING
Metal & Thermit Corporation

ALUMINUM SOLDER
Crown Aluminum Solder Co.
Metal Bond Co.

ANNEALING FURNACES
General Electric Co.
Westinghouse Elec. & Mfg. Co.

APRONS (Asbestos)
Holcomb Safety Garment Co.
Ideal Face Shield Co.

ASBESTOS INSULATED WIRE AND CABLE
Central Steel & Wire Co.

BLOW PIPES
See "Torches"

BOOKS
Electric Arc Cutting & Welding Co.
General Electric Co.
Haynes Stellite Co.
Hobart Brothers Co.
Lincoln Electric Co.
Linde Air Products Co.
Northwestern Mfg. Co.
The Welding Engineer Pub. Co.

BRAZING OUTFITS (Gas)
Air Reduction Sales Co.
Bastian-Blessing Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Linde Air Products Co.
Torchweld Equipment Co.
Victor Welding Equipment Co.
Williams & Co.

BRAZING OUTFITS (Electric)
Fusion Welding Corp.
General Electric Co.
Northwestern Mfg. Co.
Warner Engineering Corp.

BRONZE FILLER RODS
American Brass Co.
Central Steel & Wire Co.
Imperial Brass Mfg. Co.
Koro Corporation
Linde Air Products Co.
Steel Sales Corp.

BUFFERS
R. G. Haskins Co.
Keller Mechanical Engineering Corp.
N. A. Strand & Co.

BUILDING-UP ROD
See "Hard Facing Materials"

BUTT WELDERS
See "Electric Resistance Welders"

CABLE (Arc Welding)
Central Steel & Wire Co.
Electric Arc Cutting & Welding Co.
Fusion Welding Corp.
General Electric Co.
Hobart Bros.
Hollup Corp.
Lincoln Electric Co.
Northwestern Mfg. Co.
John A. Roebling's Sons Co.
Joseph T. Ryerson & Son, Inc.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

CARBIC
Linde Air Products Co.

CARBIDE
Air Reduction Sales Co.
Linde Air Products Co.
National Carbide Co.
Shawinigan Products Corp.

CARBON (Blocks, Paste, Electrodes, etc.)
Air Reduction Sales Co.
Central Steel & Wire Co.
Electric Arc Cutting & Welding Co.
National Carbon Co.

CARBON BURNING EQUIPMENT
Air Reduction Sales Co.
Bastian-Blessing Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Linde Air Products Co.
Torchweld Equipment Co.
Victor Welding Equipment Co.

CAST IRON SOLDER
Crown Aluminum Solder Co.
Metal Bond Co.

CAUSTIC POTASH
Innis, Speiden & Company

CUTTING APPARATUS, Oxy-Acetylene
See "Torches, Welding and Cutting"

CUTTING ELECTRODES (Electric Arc)
Electric Arc Cutting & Welding Co.
Fusion Welding Corp.
General Electric Co.
Lincoln Electric Co.
National Carbon Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

CYLINDERS (Acetylene)
Pressed Steel Tank Co.

CYLINDERS (Oxygen, Hydrogen)
Harrisburg Pipe & Pipe Bending Co.
Wm. Wharton, Jr., Co.

DIAMOND SUBSTITUTES (Cast Tungsten Carbide)
Haynes Stellite Co.
Stoody Co.

DRILLS, PORTABLE ELECTRIC
R. G. Haskins Co.
Keller Mechanical Engineering Corp.
Stoody Company
N. A. Strand & Co.

ELECTRIC ARC WELDING OUTFITS
Allan Mfg. & Welding Co.
Burke Electric Co.
Electric Arc Cutting & Welding Co.
Fusion Welding Corporation
General Electric Co.
Hobart Bros.
Hollup Corp.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Joseph T. Ryerson & Son, Inc.
Service Company
Stoody Co.
U. S. L. Battery Corp.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.

ELECTRIC BRAZING OUTFITS
See "Brazing Outfits, Electric."

ELECTRIC RESISTANCE WELDERS
Agnew Electric Welder Co.
Allan Mfg. & Welding Co.
General Electric Co.
Joseph T. Ryerson & Son, Inc.
Service Company
Taylor-Winfield Co.

ELECTRODES (Carbon Arc Welding)
See "Cutting Electrodes"

ELECTRODES (Metallic Arc Welding)
Allan Mfg. & Welding Co.
American Steel & Wire Co.
Central Steel & Wire Co.
Electric Arc Cutting & Welding Co.
Fusion Welding Corporation
General Electric Co.
Hollup Corp.
Koro Corporation
Lincoln Electric Co.
Page Steel & Wire Co.
Roebling, John A., Sons Co.
Joseph T. Ryerson & Son, Inc.
Seneca Wire & Mfg. Co.
Steel Sales Corp.
Stoody Company
Wickwire Spencer Steel Co.
Williams & Co.
Wilson Welder & Metals Co.

ELECTRODE HOLDERS
Allan Mfg. & Welding Co.
Burke Electric Co.
F. R. Faulk
Fibre-Metal Products Co.
Fusion Welding Corporation
General Electric Co.
Hobart Bros.
Hollup Corp.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Stoody Co.
U. S. L. Battery Corp.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.

ELECTRODE TIPS (Resistance Welding)
Elkon, Inc.

FACE SHIELDS (Arc Welding)
Allan Mfg. & Welding Co.
American Optical Co.
Burke Electric Co.
Central Steel & Wire Co.
Electric Arc Cutting & Welding Co.
Fibre-Metal Products Co.
Fusion Welding Corporation
General Electric Co.
Hobart Bros.
Hollup Corporation
Ideal Face Shield Co.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Stoody Company
Joseph T. Ryerson & Son, Inc.
U. S. L. Battery Corp.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Willson Products, Inc.
Wilson Welder & Metals Co.

FIREPROOF PLASTIC MATERIAL
Air Reduction Sales Co.
National Carbon Co.

FLUE WELDERS (Electric)
General Electric Co.
Joseph T. Ryerson & Son, Inc.
Taylor-Winfield Co.

FLUXES
Air Reduction Sales Co.
Anti-Borax Compound Co.
Bastian-Blessing Co.
Central Steel & Wire Co.
Imperial Brass Mfg. Co.
Linde Air Products Co.
Metal & Thermit Corp.
Metal Bond Co.
St. Paul Welding & Mfg. Co.
Torchweld Equipment Co.
Weldit Acetylene Co.

GAS SAVING DEVICES
Bastian-Blessing Co.
Harris Calorific Co.
Weldit Acetylene Co.

GASOLINE ENGINES
Continental Motors Corp.
Hercules Motors Corp.

GLOVES
Holcomb Safety Garment Co.
Ideal Face Shield Co.
Linde Air Products Co.

EDITORIAL

Ed Birdsall Goes to School

LAST year Ed Birdsall went to school. He left his welding shop at Madrid, Iowa, to run itself for two or three days, while he was in Ames attending the welding conference at Iowa State College. The conference furnished him with some new ideas, and when he returned to Madrid he found that these ideas could be used to improve his business. So this year when Ed received a notice of another conference at Iowa State College, he again packed his tooth brush and pajamas and went over to join the party. Returning from this trip, he was just so full of enthusiasm about the benefits which he had received personally, and which he knew his shop had received as a result of the time spent at Ames, that he simply could not keep the good news to himself. He wrote a long letter, which he had processed and mailed to all of the customers and prospective customers in his territory. In this letter he told them that he had been to school and had learned things. He gave them brief and snappy abstracts of many of the lectures which had made the greatest impression on him, giving them an idea of the kind of information obtained from these lectures, and laying particular emphasis on the fact that welding methods are constantly improving, and that new apparatus and new materials are being put on the market which make it possible to do things today that were considered impossible yesterday. Ed says frankly in his letter that he made a pest of himself—that he wandered from one speaker and from one demonstrator to another, asking them all manner of questions, based on problems which he thought might come up in his shop when customers sent certain kinds of work to him. If a question regarding procedure popped into his head, he had no intention of giving these welding experts any peace until he had several good opinions to think over. He put some salesmanship into his letter too. He took pains to point out that, as a result of the information gained by this short leave of absence, the service and the workmanship of his shop would be improved, and that this activity was just one indication of the way Ed Birdsall's shop proposed to furnish his customers with service based upon the most up-to-date practice.

Such a progressive and enterprizing follow-up may be an isolated case. The incident is by no means the only evidence at hand of the great good which is being done by the welding conferences held at engineering schools. There are a few schools which have held these conferences several years in succession, and find that the attendance has been steadily increasing from year to year. Reports received from half a dozen of them so far during the winter season are to the effect that all the speakers talked to crowded lecture rooms. The benefits to the industry are difficult to estimate, because there is no way of telling how far the missionary work started at these meetings is being extended by the individuals who attended them at a considerable sacrifice of time and money. Mr. Birdsall represents an extremely important type among the attendants at the conferences. He is a man who encounters a variety of welding problems from day to day. Information on subjects of a fundamental nature is particularly valuable to him. Possible new applications of any of the welding processes mean new business possibilities for his shop. He can use information on production welding also. In some cases he is able to do production welding for concerns who do not have a sufficient volume to justify the establishment of a welding department. He can also render valuable service to some of his big customers by giving them information on their production welding problems while he is soliciting them for special welding jobs, which their own highly specialized operators cannot handle.

Obviously, men who have arranged programs for welding conferences have given to the man in Mr. Birdsall's position a lot of value in return for his attendance. It is going to be a problem to keep on winning his approval because there is always a temptation to get away from some of these simple, fundamental and useful things and launch into studies of novelties which may not have a broad, practical application. Mr. Birdsall wants the information interpreted in terms of his own problems. He wants it presented by men who can speak either from experience or close personal observation, and who are close enough to the subject to be able to answer his questions. The number of conferences is steadily increasing from year to year, so the demand for speakers and demonstrators naturally increases. Men who are interested in extending the applications of welding should bear in mind the importance of these conferences a year from now, and make preparations to have the right kind of speakers available in all localities, so that when Ed Birdsall goes to school next year he will not be disappointed.

The Welding Wire Picture Changes

A SHORT study of the developments in welding wire during the last two or three years shows very clearly that it is becoming increasingly difficult to visualize a future program of building welding wire specifications according to old standards. The things which are easily measured seem to become of less importance, and the things which are difficult to measure assume greater importance. In fact, it appears likely that it will be necessary to develop specifications based upon performance. This is by no means a new idea, but it is one which was not generally accepted a few years ago. It would seem that the general attitude would necessarily have to change, because of the developments of what might be called entirely different types of welding wire for exactly similar jobs. Furthermore, new types of wires have entered the picture and in each type are found products in such a diversity of forms that a specification as to form would have to be extremely flexible in order to be useful. No specifications exist for shielded arc wires, automatic arc welding wires, for corrosion resisting steels, and others which are in common use because of recent developments in processes and in applications. The fields of the work represented by some of the more recent developments are really important and promise to affect a big volume of welding operations. Lacking in a standard set of specifications for wires to be used in these fields, the consumer must count upon bringing a thorough knowledge of welding processes into play when selecting the wire he is going to use. He really needs a rather elaborate and certainly a systematic method of testing, or examining, welding wire in order to make a good selection; and this testing program must be directed by a responsible individual who is thoroughly posted on welding wire subjects, who knows exactly what are the essential qualities of the welds which his firm intends to make, and who keeps posted on the changes which are being made in procedure and in materials. Some plants are making enviable economies with no sacrifice of quality as a result of a good knowledge of materials available, while others are making lamentable failures as a result of trying to affect economies by using the lowest priced materials obtainable. The welding wire used on any job is an important factor from the standpoint of both quality and economy, and it is a serious mistake for the executive in charge to fall behind his competitor in knowledge of what is going on in the welding wire field.

VICTOR FOR CUTTING

Next month will bring the announcement of the

New Victor Cutting Torch

It will be the finest hand cutting tool ever presented to the industry. New principles of design and construction will invite your attention.

A gas and air cooling system prevents back-firing even at abusive operation. The gas mixing device is so scientifically accurate that operating speed and gas economy are astounding.

A weight reduction of over 8 ounces contributes to greater handling ease. The newly designed torch handle affords hand-comfort for long hours of operation. The balance is perfect.

Light or very heavy cutting—it does not matter. The new *Victor No. 1000* is a pleasure to handle and a revelation in performance ability. Touch the high-pressure oxygen trigger valve and feel the instant flow of cutting power—swift—sure—dependable.

■■■

Next month we will present to you this outstanding Torch. Make appointments now by writing to our Main Office: 844 Folsom St., San Francisco

■■■

Distributed nationally; manufactured under VICTOR PATENTS by the

Victor Welding Equipment Co.

SAN FRANCISCO AND LOS ANGELES

Hard-Facing in Industrial Fields*

Wear Resisting Materials Which Prevent Capital Loss Are Described with Notes on Procedure of Application

By W. A. Wissler† and A. V. Harris‡

IN endeavoring to create interest in a new process or to lead to the adoption of a well-known but hitherto unused process, one of the first steps necessary is to give a reasonably complete idea of what advantages either in economy or uninterrupted operation may result from its adoption. The importance of hard-facing in industrial fields may thus be emphasized best by first calling attention to a large number of proven applications of hard-facing materials.

Airplane Tail Skids

One of the more spectacular uses of hard-facing is for airplane tail skids. Few persons not familiar with the details of aviation realize how short is the life of the ordinary tail skid. The length of service will vary greatly, depending

Figure 1. A Tail Skid, Hard-Faced, Has Twenty Times Longer Life.

upon the field on which it is used. Some fields are paved with decomposed granite, others with oiled cinders, and still others with just plain dirt. Detailed reports from one of the western fields, this particular field having a granite facing, showed that the average life of an ordinary skid was approximately 40 landings. Skids faced with a hard-facing alloy having an iron base lasted for 160 landings. Similar skids surfaced with Haynes Stellite were good for 400 landings. A skid, Fig. 1, made up with insets of tungsten carbide and faced with Haynes Stellite, lasted approximately 800 landings. Thus it was possible to increase the life twenty times by the use of hard-facing metals, at an increase in cost of only about 2½ times. When the saving in labor and time of making nineteen replacements is considered, the economy of hard-surfacing is clearly evident.

Cement Mills

Hard-facing has been so successful in the cement industry that several applications have become standard practice, the most outstanding example being the hard-facing of grinder rings. The mills usually used for grinding cement consist of a ring about six feet in diameter with a ten inch face, lying horizontally, inside of which three crushing rolls revolve and rotate, crushing the cement on the inner surface of the ring.

	Steel Ring	*Stellited Ring*
Life	400 hours	7500 hours
Cost per ring	$135	$850
Number needed	18.75	1
Repairs		$200
Total Ring cost	$2540	$1050
Time shut down for replacement and repairs	427 hours	30 hours
Average bbls. per hour	125	147
Cost of rings per bbl	.022c	.0095c
Increase in output	.....	17%

Steel rings last about 400 hours, wheras hard-faced rings will last from 4000 to 7000 hours if kept in proper condition. The data above show the ring cost and output over a period of time equal to the life of the hard-faced ring, 7500 hours.

Tractor Treads

Another application which, although developed in the Mid-West, can be utilized wherever ice is encountered, is the hard-facing of tractor treads. The set of treads shown in Fig. 3 was used on a tractor pushing a snow plow over county highways in Michigan. Formerly, on this type of work a set of treads lasted but one winter, while at the end of a similar period of service, the hard-faced treads were rolled up and saved for use during another winter. Furthermore, the four raised points on each tread prevented side slippage on the ice and hard-packed snow. As the cost of a new tread is more than seventeen times the hard-facing cost, it is easy to understand why it has become practically a standard practice to treat tractor treads in this manner in this locality.

Coke Pusher Shoes

A coke pusher shoe, when hard-faced on the bottom, Fig. 4, far outlasts the ordinary carbon steel shoe. At the end of three months, the layer of hard-surfacing material showed

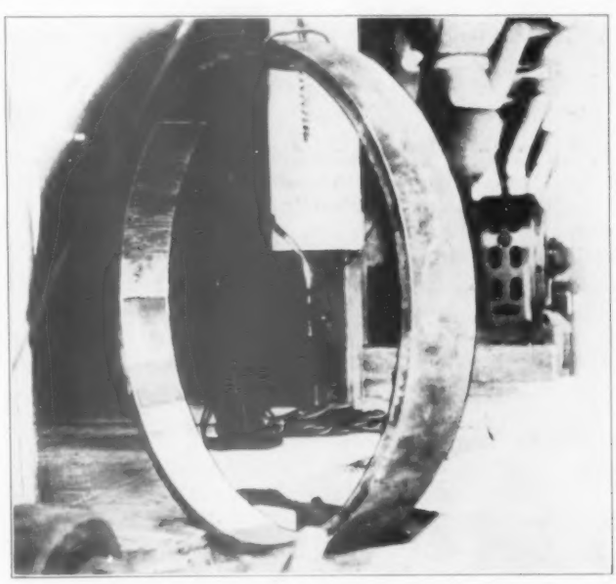


Figure 2. A Hard-Surfaced Grinder Ring Gives Increased Output at Lower Unit Cost.

a wear of but ½ in., while an ordinary steel shoe at the end of four months had worn down 3½ in. The wear ratio in this instance is approximately 100 to 1. An interesting point brought out by this application, is the fact that the furnace floor does not show as much wear when the shoe is

*Paper presented before New York Section, American Welding Society, December 16, 1930.

†Union Carbide and Carbon Research Laboratories, Inc., Long Island City, N. Y.

‡Haynes Stellite Company, New York City.

hard-surfaced as when an ordinary carbon steel shoe is used. It is sometimes believed that by increasing the life of one part, the life of the part with which it is in contact is decreased. However, the opposite is usually true. This is partly because the hard-surfacing material has a lower coefficient of friction and so slides more easily over the furnace bottom. Furthermore, because of the hard, smooth surface, small particles of coke are not picked up on the bottom and plowed along with a lapping effect on the oven floor.

Dipper Teeth

The bucket shown in Fig. 5 is one of the largest of its kind ever built. The straw hat perched between the teeth will give some idea of its huge size. It will bite out 12½ cu. yd. at a clip, an amount which will more than fill six

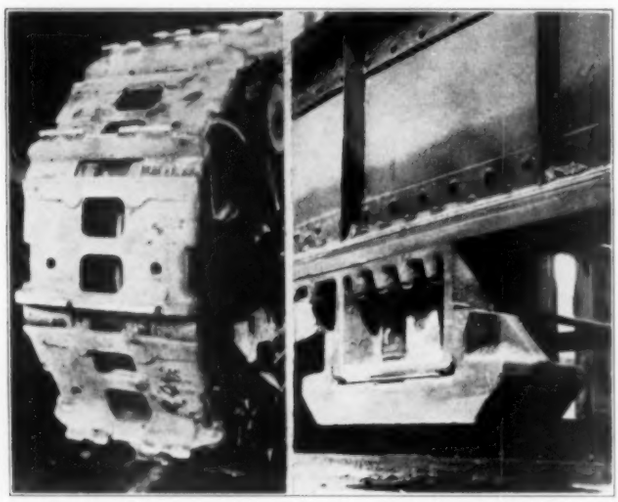


Figure 3. (Left) Hard-Facing Saves Tractor Treads. Figure 4. (Right) This Hard-Surfaced Shoe Has a Wear Ratio of 100 to 1.

ordinary dump carts. Each of the six teeth weighs 900 lb. These teeth, after hard-facing, removed 400,000 cu. yd. of dirt and limestone and were still in good enough condition to be hard-surfaced again. The service life of these treated teeth was seven times that of the original chrome molybdenum steel.

Dies

Hot forming and trimming dies, when hard-surfaced at their point of wear, last much longer than do ordinary steel dies. Fig. 6 shows a hard-surfaced die for forming Ford brake pedals, with which thirteen times as many pieces were turned out before it was necessary to replace the die. Furthermore, after the hard-faced surfaces have worn down, it is possible to rebuild the worn part and put the die back into service.

These few examples show conclusivly the economy resulting from hard-facing parts that are subjected to abrasion. However, there is a wide choice possible in the type of material to be used for hard-surfacing. These may briefly be divided into four classes. The first of these comprises alloys that are relatively low in price such as white iron or manganese steel; the second consists of alloys having an iron base and containing appreciable amounts of carbon and such elements as chromium, tungsten, manganese, silicon and sometimes cobalt and nickel. The third class is composed of the non-ferrous alloys, represented at the present time almost exclusively by Haynes Stellite, which is an alloy of tungsten, chromium and cobalt. The fourth class consists of the so-called diamond substitutes which are essentially tungsten carbide, nearly all of them being in the cast condition.

The first of these classes which consist of very cheap material should be used only in cases where the wear is very slight. The second class of materials may be used under conditions of moderate abrasive wear. This class begins with alloys that are soft and are actually high alloy steels, and covers a range of increasing hardness in which alloys containing only 55 per cent of iron are being used. Softer alloys may be used to resist moderate abrasion, and have also been used as a filling material for the harder alloys. It must be understood that they are considerably lower in price, and if a badly worn part is to be reclaimed, it is often economical to rebuild the piece with a cheaper rod and use the high grade rod on the surface only. In the third class, the non-ferrous alloy rods are designed in proportions to give good welding properties and maximum wear resistance. The fourth class of diamond substitutes have an extremely high melting point and cannot be melted with the oxy-acetylene flame. They are accordingly used as pieces of various sizes that are embedded in a hard-facing material which is welded to their surfaces and holds them in place so that their superior wear resisting properties can be utilized. It is only fair to add that the field of use for these inserts is more limited than that for the alloys of other types, all of which are completely melted during their application.

There are several physical properties that must be carefully considered in the selection of a hard-facing material. One of these is its coefficient of expansion; and it is unnecessary here to go into this point at any length. Strength is another quality, for it must be remembered that these metals have low strength as compared to steel. Probably the most important property is hardness, although a thorough knowledge of the nature of abrasive wear must be possessed in order to be able to discuss these alloys from a hardness point of view.

Everyone will realize that mechanical friction always develops heat. This heat is liberated at the contact surface

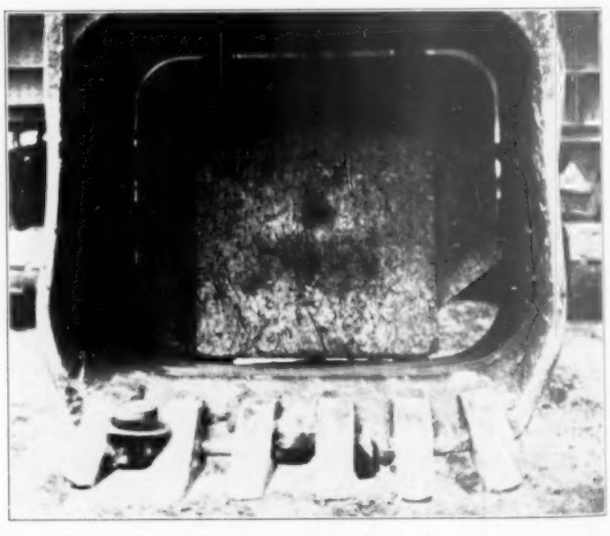


Figure 5. These 900-Pound Dipper Teeth Lasted Seven Times as Long as Chrome-Molybdenum Teeth.

between the metal part and the other material, whether it be metal, rock, wood, dirt, or anything with which it comes in contact when it moves. These temperatures exist only while the motion is continuous, and then only in a very thin surface film, perhaps considerably less than one-thousandth of an inch in thickness. However, it must be remembered that this surface film contains a very large number of layers of atoms of the alloy, and if the alloy is one that becomes soft at these temperatures, the surface will be worn away. Hence, hardness is of great value to a hard-facing metal, but it is red hardness and not cold hardness that determines the wearing life of a surface coating in many cases.

Of all the alloys of the first three classes, or to be more inclusive, all of the alloys that can be melted with a welding blowpipe when applied as a coating, the non-ferrous cobalt-chromium-tungsten alloys have the highest degree of red hardness. At ordinary temperatures they may be slightly softer than the alloys having an iron base, but as the samples are heated, it is found that the iron base alloys soften fairly rapidly. At temperatures of 400 deg. C. and over, the cobalt-chromium-tungsten alloys are considerably harder than the ferrous hard-facing metals. By actual comparison on a

Figure 6. Hard-Surfaced Dies Turn Out More Work.

Monotron testing machine, it was found that the average hardness readings of the cobalt-tungsten-chromium alloys are 75 per cent higher than the corresponding figures for the ferrous alloys over the entire range of red heat. This retention of hardness at high temperatures exists only in alloys using cobalt instead of iron as a base material.

Regarding the methods of application, hard-facing may be done by any of the standard fusion welding methods. If the oxy-acetylene process is used, there are a few simple points to be borne in mind which distinguish hard-facing from ordinary welding. In welding it is generally considered advisable to interalloy the base metal and the welding rod to secure a good bond. In hard-facing, on the other hand, such interalloying will dilute the hard-facing metal and reduce its effectiveness to a considerable degree. Hence the aim in hard-facing is to flow the alloy material over the surface of the base metal when the latter is at a sweating heat. If this is properly done, a strong junction is secured without any noticeable degree of interalloying of the two metals. Another point to be remembered is that a flame containing an excess of acetylene must be used. The reason for this is somewhat difficult to explain, but if this is not done, it is very hard to secure the proper sweating of the base metal, which usually results in the presence of more or less pinholes in the deposited metal. Finally it is necessary to see that no particles of scale are covered during the process. If these precautions are taken, any welder can, with a little practice, produce a good hard-facing job.

If the arc is used, the polarity should be reversed as is common practice with most chromium-bearing alloys. It is of course impossible to avoid considerable interalloying of the two metals, although this should be kept at a minimum. The currents required are reasonably heavy because most of the rods are cast and have fairly large cross-sections. As a general rule, in the case of Haynes Stellite, using direct current, the ¼ in. rod requires 200 amp., and the $\frac{5}{16}$ in. rod, 250 amp. Aside from these brief statements there is but little that could be told in a discussion of this kind on the technique of hard-facing. Each of the two processes has its own definite field of use and is adapted for different types of jobs.

For practically all of the smaller jobs, and especially for such applications as trimming dies which must be free from cracks and imperfections, the oxy-acetylene method is far the better. The principal advantage in the use of this process lies in the fact that the heat can be more carefully controlled, the metal can be applied with a more even surface, and fairly sharp edges or corners can be worked up. In many cases this is a distinct advantage because it reduces the amount of grinding necessary and also reduces the amount of hard-surfacing material required. On the other hand, if the job is quite large and a rippled surface is satisfactory, and particularly if the presence of a number of cracks is not detrimental, the arc is probably preferable. It must be remembered that the use of the arc for welding results in a considerable loss of metal. Perhaps 10 per cent of the material used is lost by spattering and volatilization. In the case of hard-facing materials which are sold on a basis of several dollars per pound, a loss of 10 per cent is an item that should be borne in mind if the costs of the two processes are being considered.

The hard-surfacing applications that have been mentioned give some ideas as to the economy that may be obtained through this procedure. In practically any industry in which parts are subjected to great abrasion, the application of one of the four classes of wear-resisting materials would probably prove highly advantageous. By a careful study of the conditions encountered and an investigation of the properties of the various hard-surfacing metals on the market, thousands of dollars which are lost annually through undue wearing of parts can be saved.

Western Metal Exposition Has Record Success

More than 50,000 persons attended the Western National Metal Congress which was held February 16 to 20 in the Civic Auditorium, San Francisco. Officials of the American Society of Steel Treating under whose auspices this event took place, say that this figure is an indication of an outstanding success. Engineers registered not only from many parts of this country but also from many foreign countries.

That the event was one of real service to the industrial needs of the region was expressed by hundreds of engineers and executives who were on hand. The exhibit hall of the show contained virtually every device for fabricating, treating and finishing metals. In addition there were speakers on the many programs who covered new developments in the fields of their activity. Curtailed business conditions were not in evidence, since exhibitors reported many thousands of dollars worth of sales before the show had been running two days.

"The Western National Metal Congress is now firmly established," said W. H. Eisenman, secretary of the American Society for Steel Treating, in commenting on the past event. "Two years ago the event was introduced in Los Angeles, and now the northern part of the state is enthusiastic. Plans already are well under way for the Los Angeles meeting in 1933, while the next show in the northern part of the state will probably be held in San Francisco in 1935."

Complete Battledeck Floor on Port Arthur Bridge

A current bulletin of the American Institute of Steel Construction calls attention to the fact that the first bridge constructed with a battledeck floor has recently been completed at Port Arthur, Texas. This is a highway swing bridge with a 161-foot span and is 20-feet wide. Another bridge which is now under construction and which is being built with a battledeck floor is the Bristol-Burlington highway toll bridge across the Delaware River. This, when completed, will have the longest lift-span in the world—540 feet.

Arc Welding Broken Crank Shafts

Confronted with a Complicated Problem and Unable to "Talk It Over", the Welder Evolves a Procedure from His Experience

This is a story dealing with welds of a nature that I feel no one would attempt to weld in our well-known U. S. A., welds that I fear you readers will laugh at as sheer folly from an economic point of view. And so, with this economic point of view in mind, I wish to point out our location. Let us fancy a mining camp on the west slope of the Andes, six thousand miles from its source of supplies, Mr. Woolworth's and the A. & P. Fancy a welder, a really good welder, working 48 hours a week for $6.59 (U. S.) and dashing to church on Sundays to give thanks for same. No! this is not a boost for Heywood Broun for President; it is merely a statement concerning supplies, a state of isolation, and an exceedingly low wage rate. When these factors are considered, you may better understand the wisdom of our folly.

The author was "under contract." On a certain day in a certain year we knew that we would take the 6:20 A. M. train on our way down to the sea. We had to do something to pass the time. With one year to go we laid back to rest up for the trip home, but then our friend, (as fine a man as it has been our good fortune to meet) "Sandy" Graham became Master Mechanic at one of the company's departments forty miles from where I was taking a rest cure. He was really the only man alert to the possibilities of electric welding. He ordered a four-man set, built the finest shop that I suppose is to be found south of the Panama Canal.

So we were compelled to discontinue our rest-cure and mud-baths (from passing autos) and we departed for the realm of Graham to organize and train a crew of welders, which I feel, under "Sandy," will do much to advance welding from the dormant state in which it now lies. The "Welding Engineer" may justly claim its share of the credit—there on the wall beside the "Glasgow Begorra" it hangs. And while you, safe (?) in Chicago donned your coat of armor for a stroll along the shore, we sat on top of the Andes discussing welding, the new girls at Chulas, and laughing at our transplanted peasantry.

So ends the prologue to our story. The spirit of levity ends. Do not think our efforts in the interest of science went unnoticed—we won the Chess Championship of our town and were made President of the Girl Scouts.—El Soldador.

* * *

TO those who know the Shay locomotive, there is no need to describe its crank-shaft nor the tremendous strain it has to bear. To those who are unfamiliar with this wonderful hill climber, we will quote from the Lima Locomotive Works Instruction Sheets: "The Shay locomotive is driven through power exerted on the crank shaft and then transferred to the line shafts which apply the power direct to each wheel of each truck by means of the pinions and gear rims. This makes a flexible, positive drive of great strength."

Upon arrival on this job in 1924, we were rather pleased

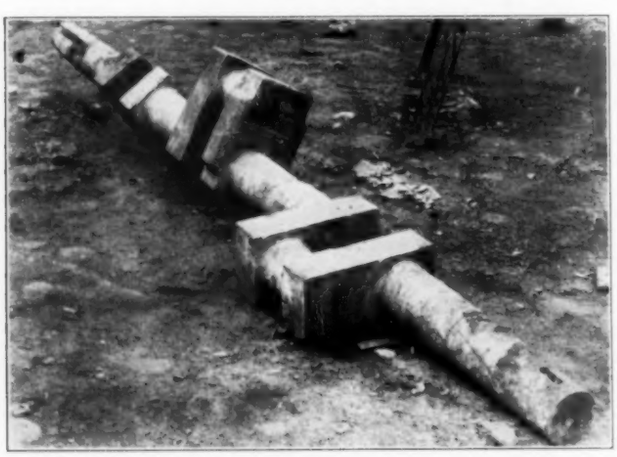


Figure 1. Completed Weld in Cheek of Center Throw.

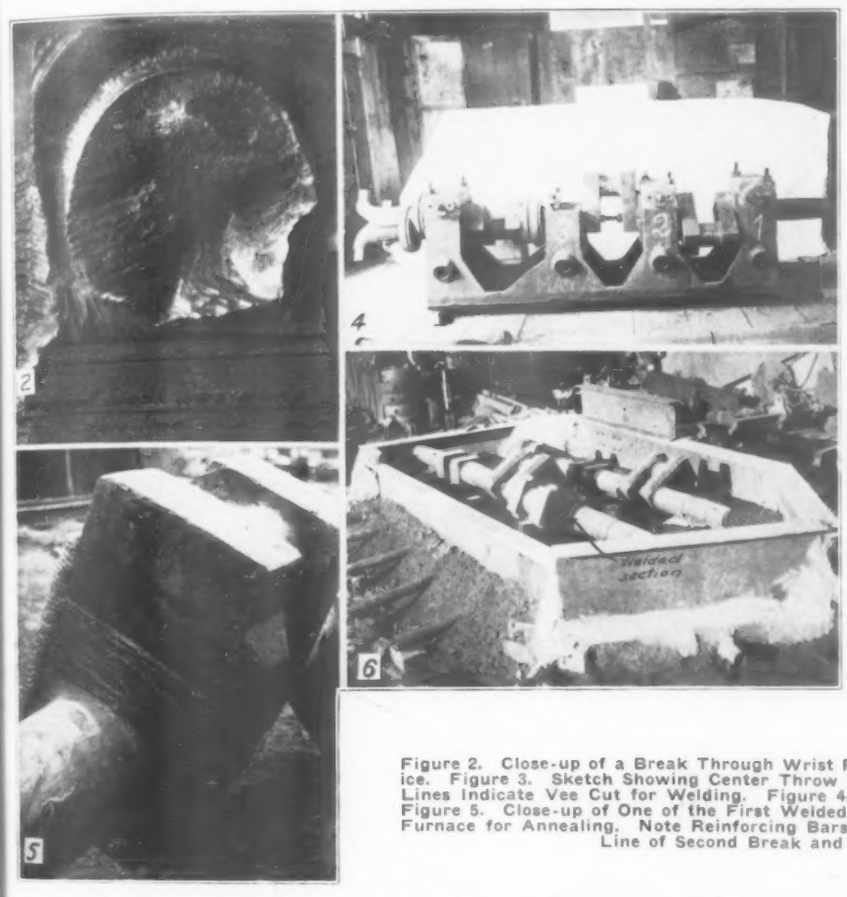
at our first sight of a half dozen broken crank shafts—here is a chance, we thought, to show them what welding will do. A few days later we were returning from a trip to the mine, and were side-tracked to allow a freight to pass. It was about 10 P. M. and to me it seemed that the roar of this locomotive on its way up the hill could be heard miles away. At last it rounded a curve—a beautiful sight, but as we watched that whirling crank shaft and realized that it was pulling that load up-hill, and as we recalled that pile of broken shafts in the valley below, and our statement that we would weld them, we experienced a sensation similar to that at the time of typhoid inoculations—a sort of sick feeling in the pit of the stomach. It was with no great feeling of confidence that we set about our first crank shaft. It was for a 40-ton locomotive and the break was through the cheek of center throw (Fig. No. 1 shows completed job). This was a three cylinder shaft, 4½-in. diameter and 7 ft. 3 in. long. Fig. 3 shows the center throw, dimensions and location of break. With a cutting torch we cut a single vee through the line of break and then secured a spare bed for this size shaft. With the aid of a long straight-edge a fair attempt at lining up the babbits was made. To me it seems that in this operation lies the success of these welded shafts—also the failures. Quoting again from the Shay Instruction Sheet: "The life of a properly lubricated and properly aligned crank shaft is almost indefinite. Crank shafts never break from being twisted off—they only break because bearings are not kept in line." Well-paid mechanics on this class of work would have greatly reduced this pile of broken shafts.

With the bed properly aligned, we placed the shaft in position, lined up the broken sections, tightened up all bolts, and tacked it securely. A shaft at this stage is seen in Fig. 4. Due to the fact that this shaft laid in babbit, we welded but an hour at a time. During the cooling period a boy cleaned the deposited metal. When it was necessary to turn the shaft, we allowed it to cool, and loosened the bolts just enough to turn the shaft. It may be noted that in this manner the shaft could not move during the welding operation. However, it was our sad experience that not one of the dozen welded shafts was straight when put in the lathe. The fact that the shafts revolved quite evenly in their bed during the time the welding was in operation leads me to believe that the contraction set up by the welding was not entirely at fault for its ultimate deflection. This procedure sounds like, and was, a long drawn out affair. There was no rush. Time was of no consequence. With the vee now solidly welded, we next proceeded to weld two reinforcing bars as shown in the close-up of weld in Fig. 5. Our first shaft was

sent out with but one pair of reinforcing bars as shown in Fig. 1. On the later shafts we placed these bars on each throw to equalize the weight. However, this lack of weight equalization in our first shaft did not seem very detrimental —this was by far our best weld—for it was in service three years and four months.

the weld had been completed, and recalling its forty months of service, it seems difficult to believe that oxidization due to close proximity of the weld had been responsible for this break.

Next and more difficult in this realm of ruptured cranks is where we find the break through the wrist or crank pin.



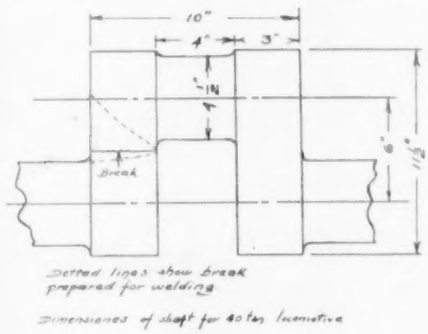


Figure 3

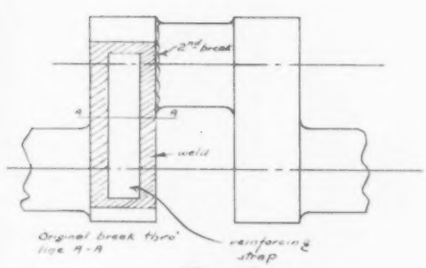


Figure 7

Figure 2. Close-up of a Break Through Wrist Pin on First Welded Shaft After 41 Months Service. Figure 3. Sketch Showing Center Throw Dimensions and Location of Break. The Dotted Lines Indicate Vee Cut for Welding. Figure 4. Shaft Lined Up in a Bed Ready for Welding. Figure 5. Close-up of One of the First Welded Crank Shafts. Figure 6. Welded Shafts in the Furnace for Annealing. Note Reinforcing Bars on All Sections. Figure 7. This Sketch Shows Line of Second Break and Location of First Fracture.

With the weld completed we now placed the shafts in an "oven" constructed as shown in Fig. 6. Contrary to appearances this was really a good attempt at annealing. Charcoal was used for heating and the shafts were held at a red heat for days. Finally the shaft was placed in a lathe and straightened. This was the final operation before going back in operation.

Now let's follow our first shaft on its career. It was placed on a passenger engine, and at 11 A. M. one morning it started on its 80 kilometer journey "up the hill"—from 1500 to 7000 ft. altitude in five hours. Its usual load was five or six passenger coaches and an equal number of freight cars. We spent that afternoon watching the Despatcher's board as it wound its way through the hills and it was surely a sigh of relief that floated from that welding shop as the train pulled into its terminal. The next day we remarked, "Well, she arrived all right." "Of course," replied my friend, "I knew it would." We regretted that we did not share his optimism—it would be such a relief to a welder's peace of mind.

After a few days we gave up worrying about this shaft and it continued on its way three years and four months, and then broke through the wrist pin in the same center throw (see Fig. 7).

In Fig. 2 you may note a close-up of the break. The original weld had been machined on the surface shown in this photo and a careful examination of the weld did not reveal any sign of a crack despite the terrific force needed to twist off the 4½-inch diameter wrist-pin.

Considering the heat treatment applied to the shaft after Of these we welded ten but were not at all pleased with the general result. Some ran a year, but, others ran only a few weeks. We shall treat the break and its probable causes in time, but a careful study of each break assured us that our system or method of welding was at fault. During our later days in South America we developed a new procedure for this sort of job, but, unfortunately lacked an opportunity to make an experiment with it.

"The time has come, the walrus said,
To talk of many things"—

but at least, let's keep them in their place, and so, returning to our subject:—the "breaks" through the wrist pins revealed the fact that a terrific force was at work and this force could be traced as follows:—(Shay Instruction Sheet) "If the middle bearing on a three cylinder engine is allowed to get out of line with the end ones, the strain per square inch on the crank shaft is more than doubled."

There was nothing novel about our procedure with this job, in fact, we followed the advice of "The Welding Encyclopedia." With a cutting torch we cut out a hole through each cheek as shown in Fig. 8. A new wrist pin was turned out, but not as the "Encyclopedia" suggests "to exactly duplicate the broken part." We increased our diameter by 1 inch, allowing for any slight error in aligning and setting the new pin in place. In any case it was necessary to machine the weld where the pin entered the cheek and, as it was almost impossible to align the pin correctly, we thought it better to increase the diameter rather than apply the arc again as a rebuilding medium. In the early stages of this procedure, great care was needed to secure proper fusion

in both pin and cheek. The operator was never hurried—he was instructed to chip out any deposited metal which he thought had not properly fused with the parent metal. We thought it best to make each operator "crank shaft conscientious" and pointed out that this was his shaft. He was responsible for it.

In Fig. 9 is shown a cross-sectional view of the pin, dimensions and weld. In this sketch we also show location of average break in such welds that failed. In this process of welding a wrist pin, it is impossible to reinforce the weld as

Figure 8. An Oxy-Acetylene Cutting Torch Was Used in Cutting a Hole Through the Cheek.

is the case in a break through the cheek. Each break showed that the rupture was through the welded metal. In no case did one of these pins break through the bearing surface. As may be noted in Fig. 9, in each case where a welded wrist pin broke, the line of break was through the welded metal and along a line as indicated by the dotted lines. Irrespective of the strength of the welded section of the break, the force that caused the rupture was at least sufficient to break the pin through an area of 12.5 sq. inches. In not one case did I find that the rupture had affected both ends of the pin, nor

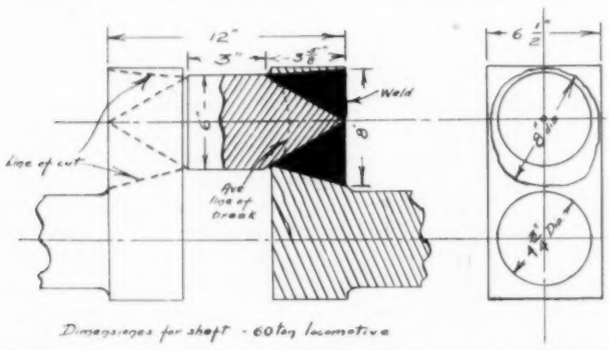


Figure 9. Cross Sectional View Showing Average Location of Failures.

did we ever find a case where the complete pin was torn from the weld. From the number of these welded wrist pins that failed, it was soon apparent that the causes that led to the breaking of a new crank shaft, if allowed to remain, would certainly break a welded pin where the weld, lacking any help of a reinforcement, was sure to fall below the original strength of the pin. With these circumstances in mind, we have worked upon a wrist pin that we feel has a better chance of success. In these days the strength of welds is fairly well known, the element of guessing has been largely removed and, allowing perhaps a larger safety factor, we can approach this subject with some degree of certainty. In Fig. 10 we show the idea. We dispense with the idea of cutting holes through the cheeks, and really create a simple vee weld that permits of a reinforcing bow on both sides. We can see no benefit in making this a solid weld. It would mean a deposit of about 125 cubic inches of weld. I have adopted an idea which I once read in "The Welding Engineer" and which I have sucessfully used in the welding of locomotive frames. In this we cut through the shaft at lines *C* Fig. 10. We then set in a new piece *D* and put in a solid weld at points *B*. We now cut a set of ¾-inch plates of a shape to suit the vee and to be beveled as shown in detail *A*. These are to be set in place and welded as shown in the projection of Fig. 10. A one-inch hole in each plate will permit welding of these plates one to the other. The strength of a weld of this sort is surprising. I saw a test made in Los Angeles in 1924 of six operations. In this test two pieces of ⅛-inch plate were used. A ¾-inch hole was punched in one plate. The plates were then lapped and the hole welded. Nine plates were welded and then an attempt made to tear them apart. In each case the plate and not

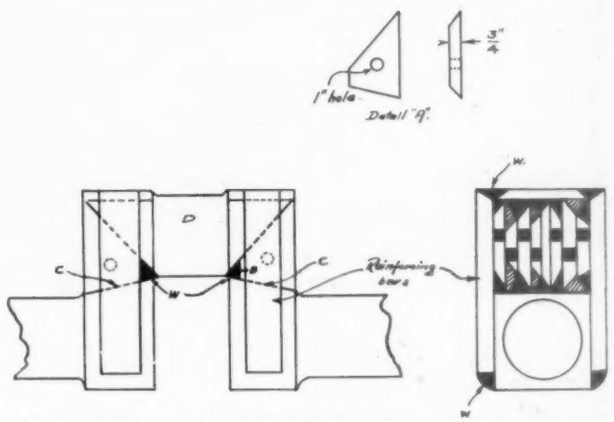


Figure 10. A Simplified Repair that Reduces the Amount of Welding Necessary.

the weld broke. The lowest went at 11,690 lbs. and the highest at 18,110 lbs.

A crank shaft welded in this manner, if a success, would be also possible from an economic point of view. The actual amount of welding is reduced to a minimum.

And so ends the story of our experience with welded crank shafts. It is not the huge success we should like to have seen it. It was to a certain extent discouraging and a bit mystifying. A friend of mine had watched the welding of the first shaft and remarked "the balance—what about the balance?" That shaft ran over three years!

A.S.T.M. Will Hold Symposium on Welding

A symposium on welding will be held during the Regional Meeting of the American Society for Testing Materials at the William Penn Hotel, Pittsburgh, on Wednesday, March 18th. A paper including a general survey of modern welding methods will be presented by F. T. Llewellyn of the United States Steel Corporation. "The Quality of Materials for Welding" is the subject of the paper prepared jointly by Dr. F. N. Speller and C. R. Textor of the National Tube Company. "Technical Examples of Modern Welding Practice" will be described and illustrated by A. M. Candy of the Westinghouse Electric & Mfg. Company. These papers will be followed by discussions of the latest developments in inspecting and testing welds, including both laboratory and field shop methods.

Where the Gas Torch Pays Dividends

Pipe Welding, Brazing and Cast Iron Cutting Are Useful Applications Featured in These Prize Stories

DURING 1930 there was conducted by the Oxy-Acetylene Committee of the International Acetylene Association a prize story contest in which cash prizes were offered for the best stories regarding the use of oxy-acetylene welding and cutting received each month. After the awards had been made, the stories were printed in the International Acetylene Association Forum, which was a regular department of the Acetylene Journal. At the time when Acetylene Journal was discontinued as a separate publication, there still remained one series of prize stories for publication. These are published below, and, as the illustrations indicate, they cover a variety of interesting subjects.

FIRST PRIZE

Cast Iron Cutting Solves a Problem in the Power Plant

By C. C. Ebright, K. G. Welding & Cutting Co.

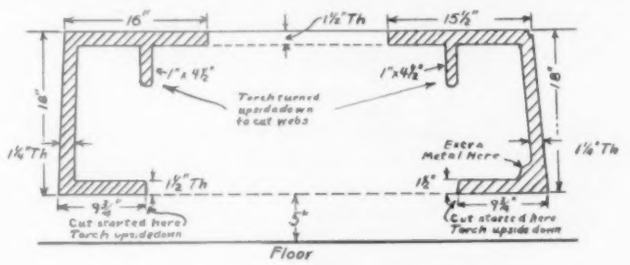
Recently, when the matter of separating the generator from the turbine of a power unit at the Robinson Laboratory, Ohio State University, Columbus, O., was under consideration, the question of the best way to do it had to be decided by Prof. Roberts and Prof. Bucher and others interested. The base was cast iron, about 1½ inches thick, about five feet wide, and a foot and a half high, roughly, with a hole about a foot and a half square in the top. The shaft was about 6 inches in diameter.

According to usual shop practice, the job could have been done, probably, with hacksaws, or possibly by drilling holes along the line of the cut, or even chiseling apart, but any of these methods would have been slow, clumsy and laborious in comparison with later practice. However, on the strength of a demonstration of oxy-acetylene cutting torch, they decided to try it on this job, and sent word for the representative to come and supervise the work, which he promised to do.

Operator Making a Cut Through the Cast Iron Base.

When he arrived, their equipment was ready and placed at his disposal. It was decided that the job was not of a size that would require more volume of gas than would be supplied from one tank of oxygen and acetylene at a time. Their oxygen regulator, however, was changed to one that had a pressure breaker attached, so there would be no restriction to the volume of pressure of the oxygen as the work progressed. The acetylene regulator appeared satisfactory and was not changed. The new torch was put on with a special tip for severing cast iron.

As the metal thickness was about 1½ inches, the oxygen pressure was set at about 45 pounds, and the acetylene at 15 pounds. A cut was started across the top, and when developed clear through, it was determined that the pressures were satisfactory and as it happened, they did not have to be changed afterward. It is always necessary to preheat cast iron considerably more than steel before attempting to cut, as it resists the action of the cutting torch remarkably.



Section of Cast Iron Turbo-Generator Base.

The metal has to be brought to a point of fusion, which is hotter than melting, and then it is only possible to continue the reaction if it is maintained at this degree throughout the cut. As a matter of fact, it is the free carbon in the cast iron that has to be dissolved, or fused with the iron, approximating a condition of semi-steel, something like the process of making steel, under the torch. At least, it will serve to indicate in a broad way the nature of the problem as compared with cutting steel. As this fusion is already effected in the making of steel, when ignition occurs at the start of the cut, the action of the cutting jet is "generative," that is, it "takes fire," so to speak, with very little effort after that, and "burns" in the direction the jet is pointed as long as it is properly ignited and there is sufficient pressure and volume of oxygen supplied. This is also true in a way with cast iron, but the fusion that was not effected in the foundry must now be done with the torch, before the so-called cutting action is possible. After that, the two actions of fusion and cutting become almost simultaneous.

When the cast iron cutting operation was completed a tip for cutting steel replaced the cast iron tip, the oxygen pressure increased and the acetylene reduced. The six inch shaft was cut in about one and one-half minutes.

The accompanying pictures and sketch will serve to show some of the details of the job. It might be interesting to note that the bottom flanges were cut with the torch held upside down, so that the flame and tip were not visible to the operator. It was suggested by Prof. Bucher that the cuts on the sides be widened out sufficiently to reach the inside edge and observe the operation from the outside. All that was necessary was to see that the tip was sufficiently clear of the metal, and then to watch the sparks to determine the progress of the cut (we do not recommend this method for beginners).

The following figures may be interesting: A total of about 96 lineal inches of cast iron was severed, most of it 1¼ and

1½ inches thick with about a foot of it 1 inch thick. When measured according to the sketch it appears that these dimensions do not tally exactly, but allowance should be made for necessary preheating before each course was started. This entire job was accomplished with 238 cu. ft.

Operators Welding 20-Gauge Brass.

of oxygen and about 130 cu. ft. of acetylene in 65½ minutes which included about 8 minutes of non-productive cutting to take pictures.

This work was done under the direction of Prof. Roberts, M.E., Ohio State University, Columbus, Ohio, under the supervision of Prof. Bucher, M.E. Thanks are to be extended to the welder, Mr. C. Knoblock, steam fitting department, for active assistance in the actual execution of the work, also to Mr. R. T. Simpson and Mr. R. L. Pratt of the Machine Shop for co-operation in this connection, and to the Photographic department of which Mr. Frank Heskett is the head for the very excellent picture.

SECOND PRIZE

High and Low Pressure Steam Lines Oxy-Acetylene Welded

By Samuel Wolk, Star Welding Co.

The ever increasing use of welded pipe may be shown by the extensive work done by the Star Welding Company of 1244 Massachusetts Avenue, Boston, Mass. This company, for a number of years, has specialized in welding pipe lines with very satisfactory results.

Both high and low pressure steam lines have been welded successfully at schools, hospitals and buildings which include Gymnasium and Building No. 1, Harvard College, Cambridge, Mass., Eastern Senior High School, Lynn, Mass., Franciscan Seminary, Andover, Mass., 75 Federal Street, Boston, Wellesley College, Wellesley, Mass., Newton Junior High School, Newton, Mass., Waltham and Waltham Metropolitan Hospitals, Waltham, Mass., Tower Building, Boston. These lines have been tested up to 500 pounds cold water pressure. The photographs show clearly the type of work done by this company.

So successful has been the application of oxy-acetylene welding to pipe lines in the heating and ventilating industries, that the Star Welding Company has been called upon to perform welding on refrigerating systems in theatres throughout New England. At the Strand and Keith-Albee Theatres in Providence, R. I., Paramount Theatres in Salem and Lynn, Mass., Keith-Albee Theatre in Boston and the Oriental Theatre in Mattapan, Mass., the air air-cool systems have been welded with excellent results. All these systems have been tested under 1,200 pounds pressure.

Expert pipe welders are maintained by this company, and all work is guaranteed.

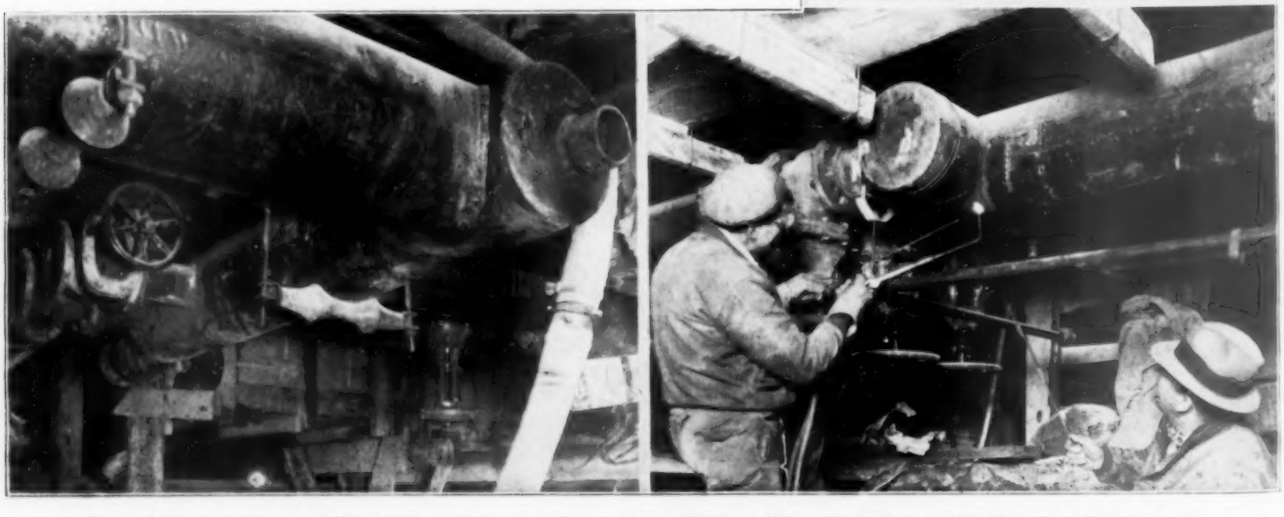
Progressive engineers, architects and building owners have recognized the superiority of welded pipe lines and are implying this fact by specifying welded pipe lines in new buildings.

THIRD PRIZE

20-Gauge Brass Is Readily Joined With Spelter and Silver Solder

By J. L. Jensen, Torchweld Equipment Co.

Some interesting manufacturing problems were encountered by a large manufacturing company, one of whose products is a public address horn. The material used in making



Several Typical Views of the High and Low Pressure Welded Steam Lines Installed by the Star Welding Company.

the horn is 20 gauge brass sheet. These are made in two parts stamped into shape, leaving two seams—each 24" in length. Because of the length of the seam, a number of assembly methods have proved unsuccessful. The job called for either welding or brazing or soldering on account of the necessity of having a perfectly solid joint, and the long seam in this thin material gave rise to problems of expansion and contraction. Several methods of preheating and tacking were adopted to prevent cracking.

The procedure finally adopted was to tack every two inches along the seam with brass spelter and then fill the remainder of the seam with silver solder. When this procedure was adopted, no further difficulty from cracking developed.

Continuous Welding of Spiral Pipe

SPIRAL welded pipe is one of the latest developments in the activities of The American Rolling Mill Company, of Middletown, Ohio. For several years this company has been watching the development of the pipe industry. As a result its engineers were set to work to develop an efficient fabricating process and kind of pipe, with which the engineer could design his line using the correct wall thickness and weight to secure the greatest installation economy. Considerable time has been spent in experimentation; more time in what might be termed "experimental production;" all this before they were ready to formally announce that they were manufacturing spiral welded pipe.

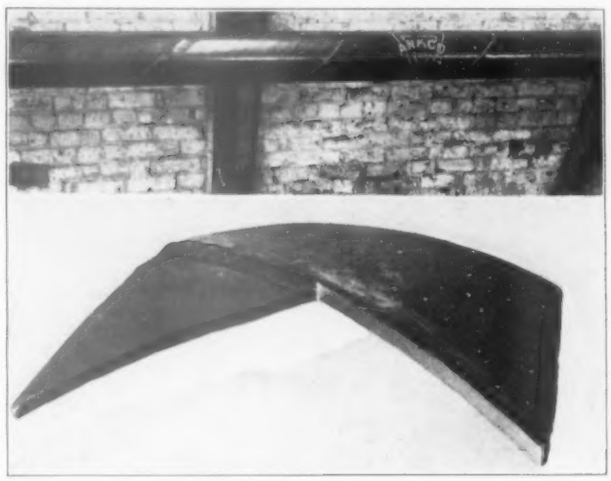
Among the favorable features to be found in this new pipe is the light weight, ease of handling, long sections which reduce the number of field joints, smooth inside wall which reduces friction and pumping costs, and, of course, a saving in shipping and handling costs.

One of the objectives of the development engineers was to develop a process which would fit in efficiently with the other operations of the company which several years ago introduced the continuous sheet mill. At one of the continuous process stages, great strips of metal as long as 200 feet, and of 16-gage or heavier, come from the strip mill, and are rapidly wound into coils. Here was the logical place to detour this semi-finished product into the machinery from whence it would emerge as spiral welded pipe.

In the modern steel industry there is a tendency toward continuous processes. Iron and steel sheets and strips are made by continuous processes; plates are rolled continuously; automobile frames and countless other formed and welded products are continuously manufactured. There are no stops, no rehandlings. Slowly, but constantly the materials ever flow forward. The result usually is a greater output, of higher quality, with a greater degree of uniformity. The manufacture of spiral welded pipe is also continuous. The long coils of iron or steel strip are placed in a decoiling device on one end of the pipe machine, which is one compact self-contained production unit. There the coil is unwound and flattened. Then it proceeds through the forming rolls and is welded. The spiral seam is produced by feeding the strip into the machine at an angle of approximately 45 degrees. The great length of the coils or metal eliminates the necessity for frequently stopping the machine to add new stock. A cut-off mechanism synchronized with the speed of the welded pipe assures accurately gaged lengths.

Complete manufacturing operations involve two separate and distinct steps. First is the fabrication. which has been described. Then follows inspection and testing. The pipe is next taken directly to a monster testing machine where it is subjected to tremendous hydraulic pressure. Standards of testing have been established so the pipe is tested at twice the safe working pressure. The latter is determined by using a fibre stress based on the ultimate tensile strength, using a factor of safety of four.

The design and inherent qualities of a spirally welded pipe are of considerable interest. It is common knowledge that when metal is joined by flame or arc welding, the resultant weld is composed of a harder and stiffer material than the parent metal. To insure a tensile strength equal to, or greater than the material it joins, the weld is made slightly heavier. Since such a joint is stiffer, and has a higher yield point than the adjacent metal, it is quite evident that the metal joined thereto will partake of this rigidity. Therefore, the spiral weld acts as a stiff spiral



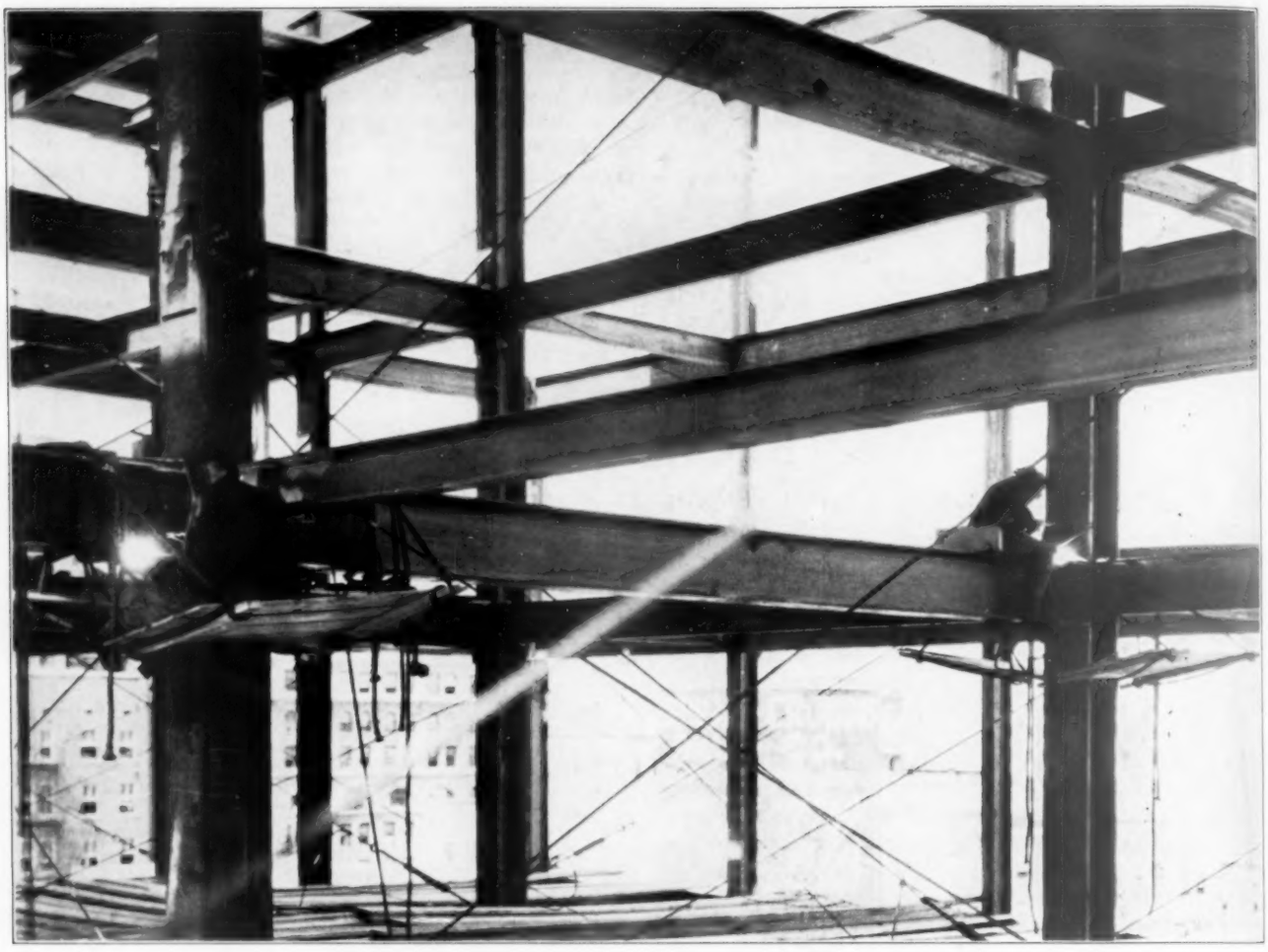
(Above) Armco Spiral Welded Pipe. (Below) Cutaway Section of Welded Spiral Seam.

band about the pipe imparting stiffness to its walls. The spiral weld compensates any shrinkage strains prevalent in straight seam welding, which locks strains into one side of the pipe, tending to curve it into an arc. One spiral turn completely balances all shrinkage strains in that section, and a straight, true-round pipe results.

To visualize stresses upon the weld in a spiral pipe under expansive pressure, attention is called to the behavior of a helical spring when a cylinder is enlarged within it.

Armco spiral welded pipe is manufactured in jointless lengths up to 40 feet. The joints are round, straight, smooth inside and light in weight. There are no interior grooves nor ridges to catch sediment or debris, or increase friction. Every ounce of metal is used to form the side walls; there are no projecting bands nor seams to add non-utilized weight. It is easy to weld, and can be used with any of the standard couplings.

The manufacturers are now supplying this pipe in sizes ranging from 6" to 24" in diameter, in any wall thickness from 12 gage to ¼ or ⅜ inch. It can be furnished with any type of coating desired—mill coat, asphalt inside and out, or galvanized. A modern pipe manufacturing plant has been established in the central works at Middletown, Ohio,—the original sheet mill plant of the company.



Welding a Skyscraper

Cost Details, Inspection Methods and Qualification Procedure Followed in Building the 19-Story Welded Building in Dallas, Texas

By F. P. McKibben

In Two Parts—Part II

THE principal difference between shop fabrication of welded and riveted steel lies in the use of clamps for holding the component parts together preparatory to shop welding, steel skids on which columns and beams may be rested while being shop welded, and only a few bolt holes for use in erection.

For smaller parts clamps were not used, the pieces being held in place by hand and tack welded. But where a large number of identical pieces are to be fabricated jigs afford a considerable saving by eliminating time lost in measuring for location of the parts. The use of skids enabled the columns and beams to be easily rolled so that practically all overhead welding was avoided.

In the design of beam and column connections care should be taken to provide erection bolts sufficiently far apart vertically at each joint to offer proper resistance to swaying of the structure before the field welding is performed. In the Dallas structure this was accomplished as shown in Figure 5. Also the erectors should screw nuts tightly on the erection bolts. The erection program should be so adjusted as to have welders follow as closely behind erectors as consistent with proper plumbing and alignment of the steel preparatory to welding. In this building steel was erected by a steel derrick with an eighty-foot boom operating as if the construction were riveted.

Five welders, each supplied with D-C Current from an individual operator motor-generator set of 200 amperes capacity, kept within six stories of the derrick. Fillets were generally ⅜" or ½", although a few smaller ones were used in certain fillers on column splices.

In tall buildings to avoid a drop in voltage when long leads are used it is necessary either to increase the current for the upper stories if the welding machines are kept on the ground floor or else move the machines upward as the steel progresses. In this structure the five welding sets were kept on the first floor till they were later raised to the ninth floor where they remained during the welding of the upper stories. As in the shop welding, $\frac{5}{32}$" and $\frac{1}{8}$" General Electric type L electrodes were used in the field.

In some of the taller welded buildings the welders erect and move their own welding platforms on which they work while welding the various connections of beams to columns. For welding column splices no platforms are in general welded because these splices usually are placed two or

three feet above the alternate floor levels. In other cases erectors put up and move the welders' platforms; and this practice was followed in Dallas. However, much welding can ordinarily be done without platforms. On the Boston Edison 14-story office building the welders arranged their own supports which consisted of Light Z-shaped steel hangers hooked over the top flange of the I-beams and extending downward alongside thereof to support a plank on which the welder worked. In most buildings the planks are suspended from the steel by ropes.

Qualification Tests for Welders

Besides the inspector of welding, eighteen men were tested to determine their ability. Of the eighteen men thirteen passed the tests; five failed to meet the requirements.

These qualifying tests to determine competency consist of three types, Figure 13; lap welds, designated "L;" butt welds, "B," and fillet welds, "F." These three types are presented as follows in the order in which the specimens should be prepared, and if possible, tested.

Lap Welds "L": Each welder is required to make two specimens, each consisting of two 6"x½"x8" plates with their 6" edges offset ½". These plates are clamped together and welded by hand along the 6" dimension. Upon cooling, the plates are broken by wedging at the free ends, and the broken welds examined for proper fusion with both plates; for density and texture of weld metal; for good penetration into right angle corner of the fillet; for freedom from gas holes, slag inclusions and other defects.

It is scarcely necessary to add that when the plates are broken apart a good weld will break through the throat or minimum section, leaving a portion of the weld metal adhering to each plate throughout the entire 6" distance.

This test is so simple that it is given first and if a welder cannot meet these requirements he should not be permitted to proceed with the other tests.

Butt Welds "B": Two specimens, each consisting of two 9"x½x1'0" plates are butt welded with a double Vee joint, one welded horizontally, the other vertically. After the weld reinforcement is removed by grinding or machining till the weld is reduced to the thickness of the plate, at least 4 and preferably 5 test strips each 2" wide are cut from each specimen and tested in tension. The average tensile strength of each group of the two sample plates should be not less than 45,000 lb. per sq. in.; and the tensile strength of the lowest in each group not less than 40,000 lb. per sq. in. Table 1 presents the results of butt-weld tests of welders who successfully passed the tests and of those who failed.

Fillet Welds "F": Each welder is required to make at least two samples as shown at "F," Figure 13, one specimen welded horizontally, the other vertically. On each side of the splice are a total of 10" of ⅜" fillet. In fairness to all parties concerned the welding inspector should insist that the fillets be ⅜" and each of 2½" length as shown. The 2½" dimension is made small to accommodate the testing facilities of the ordinary laboratory, but as a variation in length of a small amount may constitute a considerable percentage, the length of the fillet should be as near 2½" as is possible to secure. Moreover, although in general it is best on the building to leave the craters normal, that is, not filled, in making these fillet specimens "F," for sake of standardization each crater should be filled to the full section of the ⅜" fillet, and the 2½" dimension should include the filled crater. These specimens are tested in a tension machine, thus subjecting the welds to longitudinal shear, the ultimate value of which is a measure of the welder's ability. The two specimens should average a total pull of at least 117,000 lb. corresponding to 44,000 lb. per sq. in., or 11,700 lb. per linear inch shearing value of the minimum or throat section of the weld; and the lowest value of the two should be not less than 101,100 lb. total pull corresponding to 38,000 lb. per sq. in. or 10,110 lb. per lineal inch of fillet. The lowest figure, 38,000, is so small that welders whose minimum values do not at least reach that amount should be rejected.

Table I gives data for welders whose specimens were tested. For the tension tests on butt-welded specimens "B," those marked B1 are from plates welded flat, while the B2 specimens were from plates welded with joint in a vertical position. Similarly for fillet-weld tests; F1 denotes flat welding, and F2 vertical welding.

For the sake of comparison, Table I also presents results of tests made by our inspector, who, of course, had had considerable previous experience in welding and inspecting.

In studying results of tension tests on the double V butt-

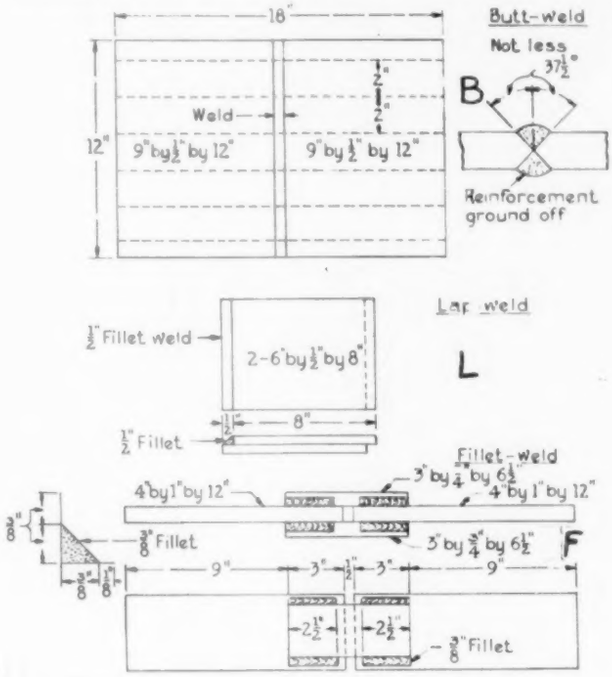


Figure 13. Welded Plates for Qualifying Welders.
The Butt-Welded Specimens at the Top Are to Be Cut into Tension Test Strips Two Inches Wide. The Fillet-Welded Specimens at the Bottom Are to Be Tested in Tension to Determine the Longitudinal Shearing Strength of the Fillets.

welded specimens it should be remembered that before the welded plates were cut into strips (approximately 2"x½" in section) the weld reinforcement was removed to secure equality between thicknesses of weld and plates.

For welders who qualified, though not necessarily on the

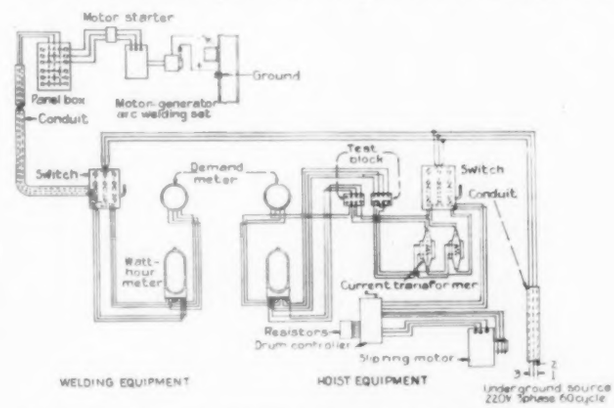


Figure 14. Electric Control Diagram for Field Welding and Hoisting Equipment.

first test; the highest ultimate tensile strength of butt-welded specimens, Table I, is 60,000 lb. sq. in.; the lowest 29,800 lb. sq. in. And the average of all 179 butt-welded specimens made by 13 welders who qualified is 48,526 lb. sq. in. The inspector's average is 51,740 lb. sq. in.

For fillet-welded specimens made by welders who quali-

TABLE I.

Results of qualification tests of one inspector and twenty-two welders who were tested. Of these welders thirteen worked on the job either in shop or field or both. Five failed to quality.

Upper part of table shows results of tension tests on butt-welds "B", each with an approximate section of 2"x½", with reinforcement machined off before plate was cut into strips.

Lower part of table shows Longitudinal Shearing tests "F". Each specimen has ten inches of ⅜" fillet on each side of splice. See Fig. 12.

Butt Weld Qualification Tests

Pounds per Square Inch

Inspector	Passed and Worked on Job														Not Passed				
Welder No.	0	1	2	4	6	9	10	14	15	17	18	19	21	22	3	5	7	11	13
Specimen No.	0B1	1B1	2B1	4B1	6B1	9B1	10B1	14B1	15B1	17B1	18B1	19B1	21B1	22B1	3B1	5B1			13B1
	52,800	44,000	55,100	49,900	50,000	45,000	43,700	37,600	41,100	34,400	55,800	53,100	50,150	36,900	38,200	43,600			48,700
	52,200	42,800	53,400	49,800	46,000	47,500	40,700	46,400	45,800	34,600	51,000	49,900	37,800	35,700	41,500	51,300			42,200
	54,700	51,900	44,400	51,800	48,900	55,300	44,100	53,700	45,700	29,800	50,500	52,200	38,000	40,500	49,600	52,700			46,300
	49,300	48,800	42,800	50,600	53,300	47,300	45,700	44,500	46,500	34,700	53,400	46,600	42,800	33,200	38,100	36,400			44,700
	53,000	54,100	44,200	49,000	46,600	53,700	48,300	42,400	45,600	32,200	51,100	50,800	35,600	38,700	51,200	51,500			45,000
Average	52,400	48,300	48,000	50,200	49,000	49,800	44,500	44,920	44,940	33,100	52,360	50,520	40,870	37,000	43,700	47,100			45,380
Specimen No.	0B2	1B2	2B2	4B2	6B2	9B2	10B2	14B2	15B2	17B2	18B2	19B2	21B2	22B2	3B2	5B2			13B2
	52,100	55,800	48,500	45,400	40,200	53,400	52,000	47,200	52,400	52,000	53,600	54,500	54,000	45,700	48,600	44,800			35,800
	48,700	56,300	48,000	48,600	46,800	57,600	48,100	51,400	51,300	55,300	52,800	57,500	46,200	42,900	50,500	47,200			33,000
	53,000	50,000	54,400	53,100	41,400	55,000	55,400	42,500	52,000	52,600	52,800	49,500	45,500	40,600	47,300	44,700			40,900
	50,300	55,700	50,700	49,800	41,300	52,100	50,200	52,500	53,600	37,200	55,600	57,800	42,700	36,800	51,100	45,800			36,700
	51,300	42,100	51,100	48,300	42,900	60,000	54,100	43,200	52,000	55,200	51,400	55,900	51,700	46,200	49,800	53,500			41,400
Average	51,080	52,000	50,500	49,000	42,500	55,700	52,000	47,360	52,260	50,460	53,240	55,040	48,020	42,440	49,500	47,200			37,560
Specimen No.										17B3				22B3					
										49,500				49,800					
										52,500				49,300					
										49,200				40,200					
										50,500				45,400					
										51,200				44,200					
Average										50,580				45,780					
Specimen No.					6B4					17B4				22B4					
					47,900					52,600				55,000					
					51,000					55,200				54,200					
					47,600					51,800				51,000					
					37,500					52,200				50,000					
					50,300					54,200				50,000					
Average					46,900					53,200				52,040					
Specimen No.				4B5		9B5		14B5	15B5	17B5			21B5						
				49,000		51,400		49,400	44,000	50,700			52,100						
				52,300		52,200		50,500	47,000	54,400			42,300						
Average				50,650		51,800		49,950	45,500	52,550			47,200						
Specimen No.				4B6		9B6		14B6	15B6	17B6			21B6						
				51,000		47,500		47,800	54,500	55,300			54,700						
				49,250		50,000		52,900	56,500	56,300			53,000						
Average				50,125		48,750		50,350	55,500	55,800			53,850						

Butt Welds	Average of 10 Spec. by Inspector	51,740 per sq. in.
	Average of 179 Spec. by Welders on Job	48,526 per sq. in.
	Average of 30 Spec. by Welders not passed	45,070 per sq. in.
	Average of 219 Spec. by all	48,200 per sq. in.

Fillet Weld Qualification Tests

Pounds per Linear Inch

Welder No.	0	1	2	4	6	9	10	14	15	17	18	19	21	22	3	5	7	11	13
Specimen No. F1	12,840	11,550	10,580	9,270	11,700	11,650	11,250	13,190	10,600	11,670	13,780	11,510	12,350	9,780	12,470	12,140	9,010	7,980	9,630
Specimen No. F2	14,250	13,300	12,540	13,270	12,500	13,120	11,900	11,000	12,500	12,140	16,260	13,890	13,760	12,510	13,790	10,960	10,960	9,050	9,900
Average	13,545	12,425	11,540	11,270	12,100	12,385	11,575	12,095	11,550	11,905	15,020	12,700	13,055	11,145	13,130	11,550	9,985	8,515	9,766
Specimen No. F3			12,750	10,680										10,770					
Specimen No. F4			14,200	13,120										13,870					
Average			13,475	11,900										12,320					
Specimen No. F5				13,100															
Specimen No. F6				12,280															
Average				12,690															

Fillet Welds	Average of 2 Spec. by Inspector	13,545 lbs. per lin. inch
	Average of 34 Spec. by Welders on Job	12,301 lbs. per lin. inch
	Average of 10 Spec. by Welders not passed	10,589 lbs. per lin. inch
	Average of 46 Spec. by all	11,985 lbs. per lin. inch

fied the maximum longitudinal shearing strength per linear inch is 16,260 lb.; the minimum 9,270 lb. And the average of all 34 fillet-welded specimens made by these 13 welders who qualified is 12,301 lb. per linear inch. The inspector's average is 13,545 lb. per linear inch. The average ultimate unit shearing strength on the throat section of these 34 specimens with ⅜" fillets is 12,301÷0.266=46,200 lb. sq. in.

Butt-welded specimens with reinforcement removed should give practically the same results whether welded in the flat or in the vertical position. This conclusion seems not borne out by comparing the averages of all flat with all vertically welded butt-joint specimens of Table I; 46,489 lb. sq. in. and 50,452 lb. sq. in., respectively, showing a considerable difference in favor of the vertical specimens.

For fillet welds, however, one expects to find slightly greater average shearing strength for specimens made with fillets welded vertically, because of the natural tendency for the molten metal in this position to form fillets with sections approximately a quarter circle instead of a triangle. Table I bears out this idea. For all "flat" welded specimens the average is 11,535 lb. per lin. in., while for those vertically welded the average is 13,068 lb. per lin. in., an increase of 1,533 lb. per lin. in.

The theoretically possible change in shape of the fillet's cross-section is very marked. For example, the throat distance of a ⅜" quarter circle is .375" as compared with the 0.266" of a triangular fillet, an increase of 0.109", or 41 percent of 0.266. One expects in ordinary welding to secure no such differences in strength, but it is possible to do so by thus enlarging the throat.

Inspection

The inspection consisted in supervising the qualifying tests of all welders in preparation for and during their work on this project; in seeing that proper electrodes and current values were used; examining sizes, lengths and locations of fillets and comparing these with the plans; examining the quality of each weld; making daily reports covering the number of inches of fillet for each connection made during the day, its location and name of welder making it.

TABLE II.

Pertinent data regarding shop and field welding of nineteen-story office building of Dallas Power and Light Company.

Item	Description		Shop	Field
1.	Electrode bought. General Electric "L"	Pounds	7100	4650
2.	Electrode melted. Assumed 70%	Pounds	4970	3255
3.	Current used	K.W.H.	No record	9460
4.	Total steel welded	Tons	1215*	1170*
5.	Welders' time	Man hours	3140	1767½
6.	Total length of 3/8" fillets	Inches	97500	56415
7.	Total length of ½" fillets	Inches	25400	17842
8.	Total length of all fillets	Inches	122900	74257
9.	Fillet per ton of steel	Inches	101.2	63.5
10.	Fillet deposited per man per hour	Inches	39.2	42.0
11.	Fillet deposited per man per eight hour day	Feet	26'-1½"	28'-0"
12.	Fillet deposited per pound of electrode bought.	Inches	17.3	16.0
13.	Fillet deposited per pound of electrode melted.	Inches	24.7	22.8
14.	Fillet deposited per K.W.H.	Inches	....	7.9
15.	Electrode melted per K.W.H.	Pounds	....	0.34
16.	Current required to melt one pound electrode	K.W.H.	....	2.90
17.	Welding man hours per ton of steel	Man hours	2.58	1.51
18.	Electrode bought per ton of steel	Pounds	5.84	3.98
19.	Electrode melted per ton of steel	Pounds	4.08	2.78
20.	Electrode melted per hour per welder	Pounds	1.58	1.84
21.	Electrode melted per linear inch of fillet	Pounds	0.04	0.044
22.	Current required per ton of steel	K.W.H.	....	8.09
23.	Erection started 7-18-'30; field welding started 7-23-'30.			
24.	Erection completed 9-3-'30; field welding completed 9-11-'30.			
25.	Height. First floor to top of tank room roof.			229'2"
26.	Height. Basement floor to top of tank room roof			245'8"

Building has heavy wind bracing in both directions.

*Difference between shop and field tonnage due to 45 tons still to be erected in a two-story wing.

Pertinent Data

Rarely does one find two steel frames alike and the results presented in Table II, giving some interesting data for the Dallas building, should be used with great care in other buildings even though these appear of similar size and design. In studying Table II one should remember that the wind bracing of this structure required much shop and field welding and that there were very few secondary or filling-in beams between the main beams.

With the aid of Table II it is possible to make a preliminary estimate for another similar building sufficiently like this structure as to render the figures applicable. Thus, suppose a structure of this type were to have a certain number of tons of steel welded; how many pounds of electrode, welding hours, linear inches of welds, and how much electrical energy would be required to field weld the estimated quantity of steel? The results can be secured by merely multiplying the number of tons of steel to be welded by the proper factors in Table II.

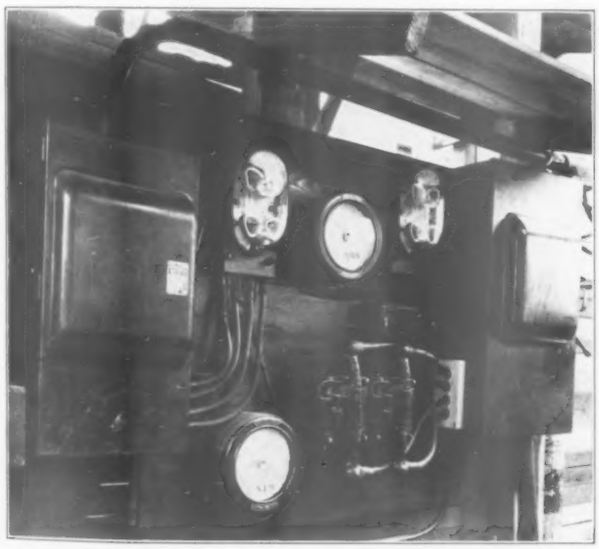


Figure 15. Meters and Switch Control in the Field.

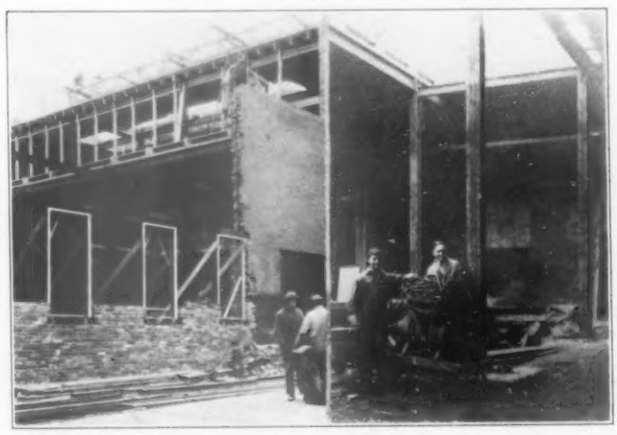
Personnel

The steel frame was designed by R. L. Rolfe, of Gardner & Howe. Mosher Steel and Machinery Company fabricated, erected and welded the structure, J. P. Churchill, works manager, being in direct charge and gave much attention to the project. Professor T. G. MacCarthy tested the specimens for qualifying welders. Lang and Witchell were the architects. Carson & Carson and the writer supervised the welding operations and designs.

Proctor & Gamble Addition Is Arc Welded

The accompanying photographs show work going forward on an addition to the Procter and Gamble Manufacturing Company's plant in St. Louis, Missouri. This added building is designed to give more room for the company machine shop, and is erected by use of the electric arc welding process.

This new building is 68 feet long, 58 feet wide and 34 feet high to the roof beams. Figure 1 shows the work in progress.



Two Views of Welded Addition to Proctor & Gamble Plant.

Fifteen tons of steel were required for the frame, all of which was erected without the use of erection bolts. Landing angles were used for welding, and all connections were made in the field. The steel was completely erected in 10 days by 6 men—a welder, helper, crane operator, two steel workers, and the foreman.

Figure 2 shows some of the details of erection. 20- and 24-inch I-beams are shown in place in this photograph. Note the simplicity of the arc welded connections. In making the beam to column connections a weld was made around both flanges and one fourth of the way down the flange. This type of connection makes a strong and rigid joint and decreases the weight of the steel considerably. The welding current for erection of this building was furnished by "Stable-Arc" welders manufactured by The Lincoln Electric Company, Cleveland, Ohio.

Early Railroad Welders Had Their Troubles

A recent issue of *Railway Age* quotes from the diary of the Boston and Worcester Railway, which was the first steam railway put in operation in Massachusetts. From this diary it appears that on February 23, 1835, one of the five locomotives in service on this road, called "The Yankee", had broken a shaft and that a Mr. Tufts had attempted to weld it. The attempt evidently wasn't successful, because when rounding a turn the shaft came apart again in the center of the weld. The passengers were brought in by horses and another locomotive sent to bring "The Yankee" home. The report definitely fixed the responsibility on the welder, but we believe that if Mr. Tufts had been furnished with some of the apparatus made for modern welding practice, he would have been able to do a satisfactory job.

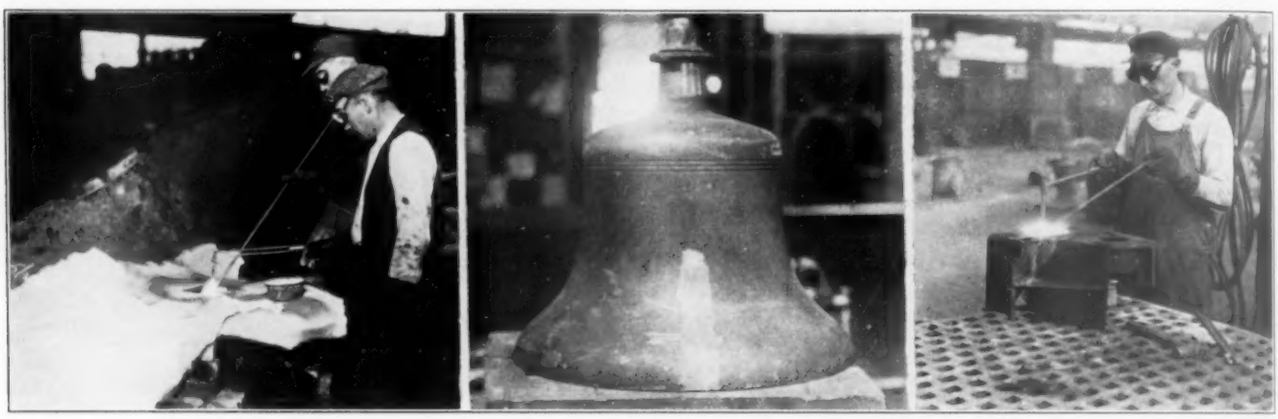
Oxy-Acetylene in Shipyard Work*

Saving in Time, Construction Cost and Obtaining a Superior Product Are Reasons Why Shipyards Use Gas Welding

By James W. Owens†

THE expression "Time is Money," and the legal phrase "Time is the Essence of the Contract" aptly expresses the managerial policy of a modern shipyard in the United States. Indeed, the time factor has become so important in ship construction and repair that the operating department of at least one shipyard has come to feel that their Sales Department has modified the phrase to read "An impossibly short time is the essence of the contract."

With the sharp competition prevailing between shipyards, the usual order of sales procedure is to appeal to the customer first on the basis of price, second on performance of the ship in service, and third on time of delivery. The third, and frequently the clinching appeal is for a time of delivery as good or better than the nearest competitor. Time of delivery is sometimes of such great importance to the customer that a penalty clause is added to the contract.



A Few Typical Repair Jobs Handled with the Oxy-Acetylene Torch in the Shipyards.

(Left) Making a Manganese Bronze Repair with the Torch. (Center) A Cracked Ship's Bell Which Has Been Reclaimed by Gas Welding. (Right) Making a Light Gas Weld.

As a result of the foregoing, the management of the type of shipyard referred to has adopted, and is looking for, equipment and processes which will aid the securing of work on the basis of either price, performance or time of delivery, and preferably on all three.

How then do the oxy-acetylene processes (heating, cutting and welding) fit in this picture? Do these processes supply a real need in ship construction and repair, and if they do, are they meeting other competitive processes on price, on performance, and time?

In answer to the first question, viz: do the oxy-acetylene processes supply a real need? Unquestionably, the answer is "Yes," for oxy-acetylene heating, cutting and welding torches have become so essential in modern ship construction and repair that it would be impossible to build or repair ships in the United States at present prices and in the "impossibly short" scheduled time without their aid. In this connection, one has only to be told that the consumption of oxygen and acetylene in shipyards in the United States for last year was over 50,000,000 and 21,000,000 cu. ft. respectively to realize that this is no idle statement.

Heating

Oxygen and acetylene are used for heating because their thermal performance insures the localized concentration of a greater number of heat units than is possible with any other combination of gases, thereby reducing the time required to do the job. A reduction in time also makes possible a reduction of cost by reducing the number of hours of labor required. Specific heating applications are the removal of buckles in plates, the straightening of damaged structural members and parts, and forming. On naval and merchant ships, the use of the heating torch has practically resulted in the abandonment of the forge, and on naval ships, the volume of oxygen and acetylene used for heating, cutting and welding is so great that it requires several days to charge the number of cylinders required when the fleet is outfitted for a battle practice cruise.

Cutting

At present, the cutting out of rivets and the cutting of plates and shapes consumes the largest volume of oxygen and acetylene in a shipyard. Here again the performance of these gases insures their use. This is particularly true for rivet cutting because the shorter the time the ship is in drydock, the less the drydock charges and loss of revenue to the ship owner.

When a ship's bottom has to be removed, the schedule time is invariably so short, and the demand for gas cutters is so great that it is usually impossible for a shipyard to meet it through its regular employment channels. To solve this problem, the Newport News Shipyard requires all student arc and gas welders to take a course in the cutting of metals before commencing their welding course.

The special suitability of these gases for rivet cutting in a shipyard is due to the shorter time required to pre-heat the rivet, especially rusty rivets, than is required by other gases, and because it is possible to remove the rivet without damaging the hole, as frequently occurs when the carbon arc is used. As there are usually thousands of rivets to be removed in a bottom repair job, the importance of reduced time for preheating and the non-injury of rivet holes are

*Read before the 31st annual convention—International Acetylene Association, Chicago, Illinois—November 12, 13, 14, 1930.

†Director of Engineering, Welding Engineering and Research Corp., New York City.

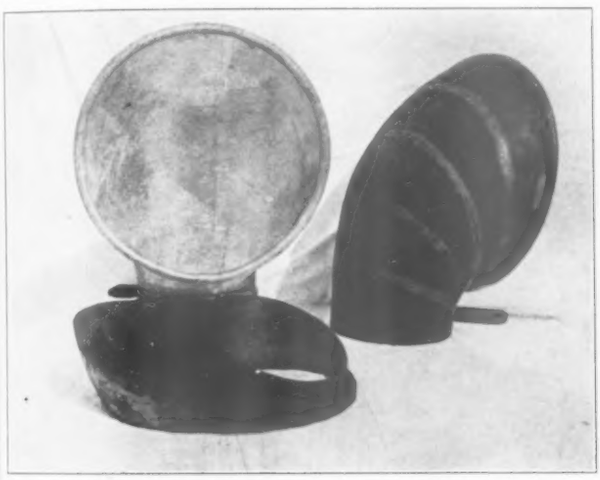
Several of the photographs shown are taken from the author's book "Fundamentals of Welding—Gas, Arc and Thermit," by courtesy of the Penton Publishing Co., Cleveland.

apparent. Damaged rivet holes frequently mean the scrapping of a plate at considerable cost and appreciable loss of time.

In the cutting of plates and shapes, the flexibility of the oxy-acetylene cutting process makes possible lower costs and shorter time to do the work, for instead of transporting the work to shears, planers, etc. the torch is carried to the work, wherever it may be—storage yards, shops, skids, or on shipboard. Today, very few sections are removed by punching, and when the section removed is of some appreciable size, handling problems are facilitated by leaving small uncut areas to hold the part removed in place until the bulkhead or other part of the ship is placed aboard. Again, port holes are usually never cut out until the plates are completely riveted or welded in place. The cutter then systematically cuts one hole after the other on board the ship.

Welding

Coming now to welding, we find the welding torch used extensively for the welding of all the non-ferrous metals



Oxy-Acetylene Welded Vent Cowls for a Merchant Ship.

and light sheet steel. Applications which have recently come more into vogue are the use of bronze welding for the repair of cast iron and the welding of piping systems, both in the shop and on shipboard. The reasons for this latter application are that recently developed welding rods make possible the securing of a joint having physical characteristics equal to or better than the base metal, the metal can be deposited in any position (flat, vertical or overhead) and the time and cost of inspection is reduced to a minimum as leaks are practically eliminated.

How to Increase the Use of Oxygen and Acetylene

Having specified the principal uses of oxygen and acetylene in a shipyard, I will next consider means for increasing the use of these gases.

About eight years ago, when I recommended to users of

Dory Heads Fabricated with the Torch.

arc welding that they consider the use of larger electrodes and higher current values to reduce time and cost, a protest was made by some manufacturers on account of their inability, at that time, to furnish machines to supply the higher currents required. Having observed the performance of oxy-acetylene heating torches, tested practically every cutting and welding torch on the market, and experimented extensively with submarine cutting torches, I am led to the conclusion that oxy-acetylene equipment now supplied for the uses referred to is comparative in its limitations to the commercial arc welding equipment of eight years ago, viz: its inability to comply with the extremely exacting and heavy demands required of it in present commercial practice. Let us consider a few specific instances. I do not know of any oxy-acetylene equipment which is specially designed along engineering lines for heating as required in a shipyard. That is, equipment so balanced in design, that the volume of gases needed for intensive, quick and localized heating are supplied without increasing the acetylene pressure to, what is generally considered, the danger point. This lack of balanced design is also true in equipment for the cutting of heavy sections. In this latter case, these limitations of present equipment were observed when, due to the scrapping of an electrolytic oxygen producing plant, acetylene was substituted for hydrogen. I have several times suggested the need of a torch for the cutting of holes for assembly purposes, and hope some day to see such a torch in common use.

From the Heaviest to the Lightest—Everyday Cutting Operations in the Shipyard.
(Left) Cutting a Heavy Section in the Forge Shop. The Torch is Controlled with a Radiagraph. (Center) Making a Light Manual Cut. (Right) The Cutting Torch Makes Short Work of Scrapping a Battleship.

Insofar as the welding of heavier plate is concerned, my opinion is that to further increase the use of oxy-acetylene in this class of work, it will require not only a thorough analysis, in the remotest detail, of equipment design but a thorough co-ordination of all details of technique and the utilization of many minds and the best talent available.

From the Largest Down to the Smallest.
(Left) Oxy-Acetylene Welded Condenser Tube Sheet. Note the Size of Workmen Standing Beside It. (Right) Gas Welded Heater Coils for an Oil Tank.

Conclusions

In conclusion, I would like to call your attention to the fact that the Newport News Shipyard, the largest user of oxygen and acetylene, is at the same time considered the largest user of arc welding among merchant shipyards. The point that I desire to emphasize is that the extended use of arc welding in this yard has not decreased the consumption of oxygen and acetylene. In comparing Navy Yards, this ratio is probably also true, although figures are not available. Again, experience has shown that the greater the number of applications in a shipyard wherein oxy-acetylene is considered to be irreplaceable from the economic standpoint, the greater the reluctance of that yard to utilize any other gas. Finally, it is apparent that the oxy-acetylene processes as at present utilized in shipyards, supply a need which no other process can, in most cases, compete with on one or all of the three factors, cost, performance, and time. Nevertheless, it is believed that a marked increase of oxygen and acetylene can be secured to shipyards, by a consideration of the problem from the standpoints outlined or intimated.

"Flash" Butt Welding a Forging to Seamless Tubing

By W. F. Pravel, Southwestern Manager, Taylor-Winfield Co.

RESISTANCE "Flash" butt welding has built reliability into the very heart of the new Servel Hermetic electric refrigerator, and has aided in building up a simplified design.

In this new refrigerating unit the crankshaft forms the oil pump, with the pumping or oil circulating action being brought about by a vacuum created in the hollow or tubular section of the crankshaft, as it revolves.

Figure 1. (Above) Crankshaft and Oil Pump Unit as It Comes from the Welder. Figure 2. (Below) How the Weld Resisted a Bend Test.

Servel, Inc., engineers spent years in the design and development of this new refrigerating unit. When their tests proved it advisable to adopt the type of crankshaft and oil pump, as is depicted by Figure 1. They decided to make it from a forging and piece of cold drawn seamless steel tubing. This decision was prompted by the elimination of much expensive machine work, but also "flash" butt welding provides the strength of a solid piece of steel. Incidentally, this type of welding is also being used extensively on vital motor car parts, for joining large sizes of pipe end to end, and for many other places where maximum strength is required.

Figure 2 weld portrays the strength of this "flash" butt weld, without the necessity to present to the reader a lot of technical test data. You will note the weld did not fracture, after the piece was bent to a considerable angle. Rather the bell of the crankshaft was the first to show a break. This piece would never be subjected to any such severe test in service, but it is a typical example of the inherent strength of "flash" butt welding. This particular "flash" butt welding operation is performed on a "Taylor-Winfield" 45-degree angle top butt welder.

Those familiar with the problems of locating work into the machine while clamping, will readily appreciate why this user found this type of machine advisable. The work is directly under the operator's observation, and therefore not only facilitates locating, but also speeds up this operation. This is rather a precision butt welding job, and the machine is equipped with roller bearing slides, hardened and ground wearing parts, and so on. This type of machine construction makes it "flash-proof."

Figure 3. The Completed Refrigerator.

That "flash" welding has shattered "rule of thumb" ideas in design is becoming more and more evident. The men at the designing boards, and engineers in executive capacities are projecting their minds into the shop, with the possibile thought of a wider use of resistance welding.

So much experience and sound data is now available on the subject of resistance welding, that problems involving its use are being approached with a genuine scientific understanding. Like other welding methods, resistance welding is creating some revolutionary methods of design and manufacture. It therefore deserves quite justly the rather close attention it is receiving from the modern manufacturing world.

Certifying Welds*

By Subjecting Welding Procedure to Engineering Control We Can Be Reasonably Sure of Obtaining Satisfactory Welded Structures

By H. L. Whittemore†

As changes in industrial processes come more and more rapidly, the difficulty of obtaining workmen skilled in the new processes and methods becomes greater. A good example is fusion welding. Many welders apply for the jobs, but comparatively few of them make satisfactory welds. Training courses in the fundamentals of welding become necessary and are being provided by both educational and commercial organizations. There is no need to discuss here the teaching methods which are most successful.

The success of a welded structure of any kind depends not only on the care and skill of the welder but upon the base metal, the welding rod and gases, the torch and other apparatus, and the design of the joint. The skill of the welder is only one of several factors which vitally affect the finished work. It is usual, when testing welders, to include all of these factors except the design of the joint by having the welder use the materials, equipment and procedure which are to be used for the work on which he is to be employed. Any statement that a workman is a good welder which does not also give, rather fully, the conditions under which he makes satisfactory welds is just as much nonsense as the bare statement that he is a "good" man. We should all cultivate the critical mental attitude of the man who in an argument was hard to convince. When a friend in exasperation asked if he would agree that the sheep over on the hillside had been sheared, the man considered for a moment and admitted grudgingly that "this side of each sheep appeared to have been sheared."

It is evident, then, that testing the welders and testing the welds are so closely interlocked that it is impracticable to separate them. Everyone is satisfied if the welds are satisfactory.

Although satisfactory oxy-acetylene welds have been made for many years it is only during the past few years that the methods have been crystallized into definite procedures for particular jobs. The "know-how" in the head of the expert welder has, for many jobs, been put down in black and white for the use of the entire gas welding industry, and tests are given in the procedure control for determining the quality of the welds.

Although the progress which has been made in procedure controls and tests has been very gratifying and will in most cases insure satisfactory welded structures, the building officials of our cities, the insurance people, and the man who pays the bills do not hail welding with the enthusiasm we have a right to expect. When it is proposed to fabricate the design by welding, these gentlemen hesitate, then express their doubts. Often they admit readily that welding has been used satisfactorily for similar work. Finally, it is learned that they want to know what assurance they will have that the welds will be good. A statement as to the financial standing of the company taking the contract makes, apparently, no impression.

Something must be done. How can these gentlemen whose approval is necessary, be convinced that the welding will meet their expectations. Someone suggests that these gentlemen inspect and test the work as it progresses, but they can't. They have neither the technical knowledge nor the training to undertake such work. As well expect the passenger who complains of delays due to fog at sea to take the bridge.

The laboratories which inspect and test engineering materials have not, as yet, established a reputation for service of this kind in the field of welding. The urgent need at present is for a service which will study and criticize the suitability of a design for fabrication by welding, inspect, test and approve the materials and workmanship as the work progresses, and, finally, certify that the finished job complies with the specifications. The inspection service would in effect stake its reputation that the purchaser would have no reasonable cause for complaint. It should, therefore, be extremely cautious about certifying structures welded by new and untried methods. As this service is essentially the agent of the purchaser, it should be supported by the purchaser.

The contractor should not inspect and test for the purchaser for the same reasons that a lawyer cannot represent both the plaintiff and the defendant in a law suit.

Where is the organization which is ready and willing to "Certify Welds" which will not only make sure that the welds are right, but which follows methods which inspire confidence in both producer and consumer? An organization which is *"sans peur et sans reproche"?*

An inspection service of this kind should be hailed with delight by organizations doing welding because it would to a great extent relieve them of the necessity of maintaining a staff of welding engineers and supervisors. In small organizations employing only one or two welders, the design of welded structures with adequate supervision and tests is a very serious financial burden. This work could well be cared for by an outside organization just as lawyers and certified accountants care for other phases of the business.

Suppose, for example, that a welding company fabricates a structure under contract which fails under unforeseen conditions, such as a tornado, causing a spectacular loss of life. Imagine the headlines in the newspaper the next morning. Another disaster due to welding. Even if the fractures occurred at some distance from the welds, it will be extremely difficult to convince the investigators beginning with the coroner's jury, that welding, a comparatively new process, was not the cause.

If the welding company could immediately produce certificates from a recognized inspection service showing that each welder on the job had fully met qualification tests, that the design was based upon the results of tests, it would force anyone who stated that the welds were at fault to *prove* his contention. These certificates might well be impressive looking documents bearing the signature and a passport photograph of the welder, a statement of the essential results of the qualification tests, and sworn to before a notary by members of the staff of the inspection service.

A description of these certificates in the technical press would be effective advertising for the welding company.

To prevent the inspection service from becoming autocratic in its decisions, the procedure controls and methods of inspecting and testing should be submitted for approval to the industry as represented by the International Acetylene Association, the American Bureau of Welding, and other organizations.

---

*Publication Approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

†Chief, Engineering Mechanics Section, U. S. Bureau of Standards, Washington, D. C.

Hollow Steel Lumber

By W. O. Sheldon

SINCE fabricated steel has become so popular as a substitute for window frames and door frames, doors, partitions, and moldings in both light and heavy building construction, it is only logical to expect a steady development in the production of steel lumber for the interior framework of light structures such as residences. Considerable experimental work has already been done in the use of standard structural shapes for the exterior framework. There has also been a constant expansion in the use of steel parts for interior construction and trim. Welded steel truss beams are available in several styles. Steel floors are being accepted for practically every type of building, and metal lath has been a popular building material for some time.

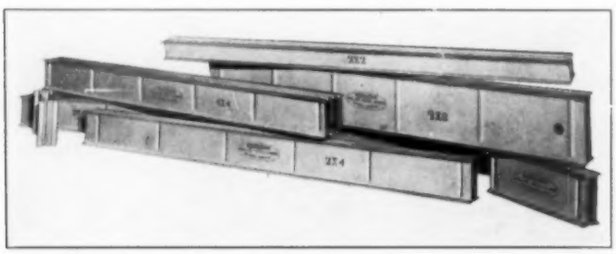


Figure 1. Hollow Steel Lumber of the Same Shape and Dimension as Standard Wooden Lumber.

There has been no extensive use of steel shapes for the interior framework, because the heavy weight of ordinary structural shapes involves the use of an excessive amount of steel.

It has been estimated that about 800,000 residences are built each year in the United States, along with hundreds of thousands of smaller buildings. This would indicate a potential market of enormous proportions for a light, practical steel-frame lumber, which should consume thousands of tons of sheet steel when properly fabricated.

To meet this growing demand for light steel construction, the author has invented a type of light-weight, hollow steel lumber of such shape and construction as readily to supplant the ordinary wood beam, joist, studding, etc., these standard shapes retaining all the standard dimensions of wood lumber. The fabricated sections are made of two identical sections, seamed together; and when the different sizes and shapes are assembled in building construction, all parts are spot welded together, making a one-piece frame. The material lends itself particularly to that form of construction where the material can be cut to dimensions in the shop where fabricated, and then assembled on the job. As this steel lumber can be made at the rate of 100 ft. per minute and assembled in the building by simply spot welding the frame together, it seems to offer a form of construction particularly adapted to low-cost building construction. There has been developed a very practicable hand-punch of sufficient capacity to punch the flanges of this lumber, as well as the cleats, making it entirely suitable for riveting where spot welding is not convenient. However, there has also been developed an entirely satisfactory means for spot welding the frame together in erecting. This spot welding can be done at any distance from the transformer. In fact, a means has been worked out whereby the current can be generated on the job, wherever necessary.

Figure 2. Clips Used for Spot Welding Steel Lumber Assemblies.

The sections, as produced, are duplicates of wood lumber in size, making their application entirely simple, since contractors, estimators, architects and carpenters do not have to learn a lot of new tables or formulas. A 2x4 in this hollow steel lumber is the same size as a 2x4 in wood, and so on with all other sizes. In other words, there is nothing new to learn in its use, except to use spot welding instead of nailing.

Along with the hollow steel lumber, there have also been developed certain simple and easily applied steel shapes, cleats and plates, shown in Fig. 2, for securing the framework of a building together and facilitating the spot welding of the frame under construction. In Fig. 3, the application of these cleats in a typical assembly is clearly indicated.

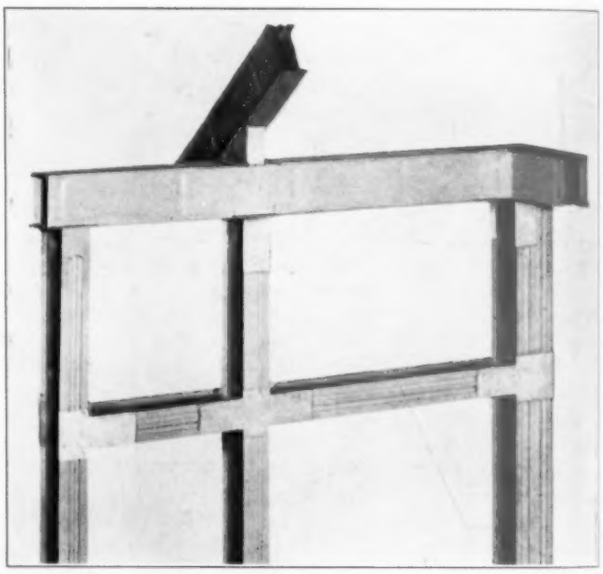


Figure 3. Illustrating How a Few of the More Common Building Connections Can Be Made.

Scientific tests of some of the sections illustrated in Fig 1 show the following results: The 2x4 section made from 22-gage steel, on 45-in. centers and under a center load of 850 lb., showed a deflection of 0.118 in. and a permanent deflection of 0.024 in. The 4x4 section of 22-gage steel, under a center load of 1500 lb. on 45-in. centers, showed a deflection of 0.166 in. and a permanent deflection of 0.028 in.

There is no doubt that this steel lumber would make construction more durable and fireproof. The strength of these rolled sections would occasion many economies in residence construction. Instead of placing 2x10's on 16-in. centers, these steel beams could be spaced 32 in. apart, eliminating all cross-bracing; 4x4's or 4x6's are strong enough to use for corner posts, 2x2's and 2x4's can be used for studding, 2x6's for rafters and stringers, and 2x8's for stringers carrying floor loads. Used in connection with metal lath, steel floor plates, metal ceilings and steel roofing, along with interior metal trim, this steel lumber results in an all-metal building of fireproof construction.

This type of lumber has some features which should prove of great interest to those interested in the extension of the

welding industry. It points the way toward the construction of all-welded residences without involving difficult calculations to arrive at a feature design. The author has suggested the use of spot welding for field erection. It is obvious, however, that this material can be assembled either in the field or in the shop by any of the welding processes.

Oil Equipment & Engineering Exposition in Los Angeles in March

Considerable interest is being displayed throughout the oil industry in the Second Annual Oil Equipment and Engineering Exposition which will be held in Los Angeles, Calif., from March 16th to the 22nd, 1931. This exposition is a technical and scientific exhibit of the world's newest developments of instruments and equipment of the oil industry. This display of tools and machinery being used in the drilling, production, transportation and refining branches has a greater significance this year because it will be the only oil exposition to be held in 1931.

Added attractions which offer great benefit to both the oil

Where the Los Angeles Oil Show Will Be Held.

men and the manufacturers are the new buildings which have been erected especially for this purpose. The location is near 131st and Alameda Streets in the south section of Los Angeles. Every modern facility has been provided to exhibit the equipment under ideal conditions.

The main building is 400 ft. by 180 ft., and gives an exhibiting area of 72,000 sq. ft., which is on one floor and under one roof. Outside space adjacent to the main building is provided for the display of derricks and larger machinery.

The latest designs in equipment which are aiding in the solving of oil field problems will be shown. There will also be on display hundreds of newly invented devices which are not yet being manufactured, and among these will be included various makes and types of welding equipment with demonstrations of their uses and application in oil field work.

An 80 ft. by 40 ft. extension has been added to the main building for exclusive use as a meeting room for the various societies which will hold meetings during the Exposition. In all probability a number of meetings of the American Welding Society will be held in this room during the exposition. This room is being equipped with a permanent screen for the showing of slides and motion pictures.

Oil field welders and others are keenly interested in attending this exposition, as it furnishes them the opportunities of gaining new ideas on the application of welding in their line of work, and keeps them abreast of the times in new developments in welding, late equipment, etc. Demonstrations are now being planned by some of the leading welding equipment concerns on the Pacific Coast to illustrate most clearly to the visitors the application of the various welding methods and operations. Air, gas, and electric power are being provided by the exposition for use in these demonstrations.

The new exposition buildings were completed last August, and at that time a Permanent Exposition of oil equipment was inaugurated. This permanent display service is open throughout the entire year and has been visited by representatives of countries from all over the world where oil is produced. Oil men from the California fields naturally take advantage of it by making frequent inspections of the new equipment there on display, and men from all parts of the United States visit it whenever they are in Los Angeles.

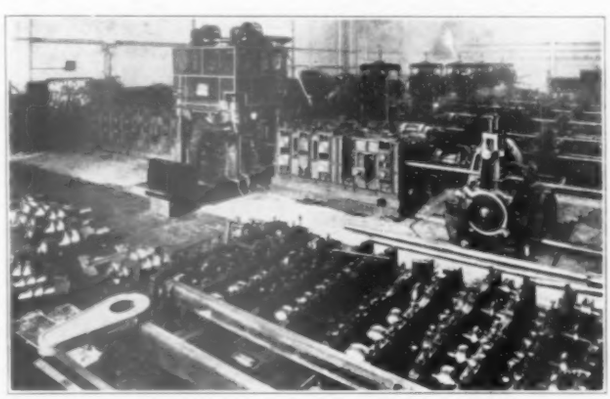
I. A. A. Oxy-Acetylene Committee Gets Under Way

The past month has seen considerable activity on the part of the Oxy-Acetylene Committee of the International Acetylene Association. W. D. Flannery, President of the Association, appointed the complete committee during January with W. H. Ludington, Air Reduction Sales Company, New York City, Chairman; G. O. Carter, Linde Air Products Company, New York City, Vice-Chairman of the Eastern Section, and C. T. Price, Compressed Industrial Gases, Inc., Chicago, Vice-Chairman of the Western Section. Sixteen members of the committee comprise the Eastern Section and an equal number the Western Section. Both sections have already had meetings so that the work of this committee for 1931 is well under way. The complete report, reflecting the activities of the committee, will as usual be presented at the Annual Fall Meeting of the Association. Meanwhile it is planned to prepare a series of bulletins during the year which will keep members of the Association informed from time to time regarding the work of this member group.

Welded Tubing Now Available in Larger Sizes

The completion of a new electric welding unit which greatly increases the range of steel tubing produced by the Johnson process is announced by officials of Steel and Tubes, Inc., of Cleveland, a subsidiary of Republic Steel Corporation.

After several years of experimental work, a machine has been developed which will weld tubing of much heavier wall thickness than has heretofore been possible and up to 5 inches



A Battery of Tube Welding Machines.

in diameter. Sizes formerly direct welded in this manner ranged from No. 26 to No. 11 gauge. The new unit electrically welds tubing up to ¼ inch in thickness, increasing the wall range to No. 3 gauge, all intermediate gauges being included.

The new machine is so constructed that large coils of flat steel stock are fed into the forming rolls to be formed cold into a tube. This passes directly under the electrodes where fusion takes place without the addition of other metal at a

speed of approximately 80 feet of tubing per minute. The welding burr is eliminated and the weld is almost imperceptible. The process is practically continuous and is not only much faster but produces a better finished product from the standpoint of strength and appearance. Welding power for the machine is drawn from the lines at 2300 volts. When operated at full capacity, over 1200 kilowatts of electrical power is concentrated continuously in a spot no larger than the eraser on a pencil.

Continuous testing takes place, samples being expanded until the wall fractures. This fracture must occur at some point other than the weld to allow the welding machine to continue in production. Ductility and hardness tests insure correct temper.

The new machine permits exceptional uniformity of wall thickness, a tolerance of .004 to .008 inches plus or minus being observed and in some special cases even less. The Johnson electric welding process has recently been extended to high carbon structural tubing by Steel and Tubes, Inc. The company is the largest producer of electrically welded tubing, manufacturing round, square, rectangular, oval and ornamental tubing in all sizes from ⅜-in. to 5-in. O. D. as well as bent and formed tubing and fabricated parts. It also produces the widely used threadless conduit known as Steeltubes Electrical Metallic Tubing.

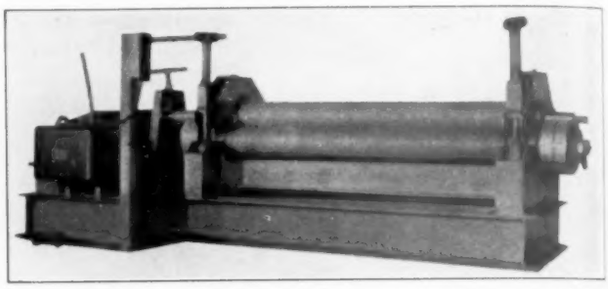
Georgia Welders Pleased With Conference

According to report received from H. G. Wilson, District Manager of the Burdett Oxygen Company, Atlanta, Georgia, the welding conference which was held at the Georgia School of Technology, Atlanta, on February 5 and 6, made a distinct hit. This is the first event of its kind which has been held in that neighborhood and Mr. Wilson states that all those who attended were high in their praise of the Mechanical Engineering Department of the school for taking the initiative in this piece of work. Representatives from all types of industry in this section attended and there appeared to be plenty of interest for both the larger manufacturing companies and the small repair shops. It was estimated that approximately 300 visitors attended the two-days' program, details of which were published last month. It is thought that on account of the marked success of this first conference plans will be made to establish this as an annual event. The illustration which shows the booth prepared by the Burdett Oxygen Company for exhibiting their products and service is typical of the displays which were arranged to give visitors an opportunity to look over the latest developments in welding and cutting equipment and materials.

Burdett Booth at Georgia Tech. Conference.

Design for 48-Inch Plate Roll Submitted for Prize

The design of the 48-inch plate roll shown in the illustration is being submitted as an entry in the Second Lincoln Arc Welding Prize Competition by W. A. Barber of the American Crane Co., Friendship, N. Y.



Design for This Plate Roll Entered in Prize Contest.

This machine has rolls 6-inches in diameter and the main frame is made up of 8-inch Bethlehem H-columns. The entire unit is structured together by arc welding. After completion of the welding which is used also on the roll bearings and the gear case, the entire unit is machined. Permission for publication of the picture is given by Mr. Barber.

One Hundred Cities and Towns Have Adopted Welding

The number of cities and towns in the United States which have adopted legal provision providing for the use of welding in building construction, now totals 100, according to Frank P. McKibben of Black Gap, Pa., consulting engineer for the General Electric Company. Of this total, 90 have adopted welding in accordance with the Pacific Coast Building Officials Conference Code, six follow the American Welding Society's code, and four have adopted miscellaneous unclassified codes. The essentials of all these codes, however, are similar to and are based on the American Welding Society's "Code for Fusion Welding and Gas Cutting in Building Construction."

New Orleans is the largest city which has adopted a welding code. The tallest all-welded structure is the 19-story office building of the Dallas Power & Light Company in Dallas, Texas.

California has the most cities and towns with welding codes, 67 having incorporated sections providing for welding. Oregon is second with six; Washington has four; Arizona, Louisiana and Texas have three each; New York and Massachusetts have two each, and Arkansas, Colorado, Montana, Nevada, New Mexico, North Dakota, Delaware, New Hampshire, Alabama and Mississippi have one each.

General Electric Co. Will Save Money by Welding Cleveland Building

Evidence that welding as a method of building construction has arrived at a point where it is cheaper than riveting in many cases, is found at Nela Park, Cleveland, where the General Electric Company is to start work immediately on the construction of an industrial building. This building, to be devoted to the manufacture of wire for the incandescent lamp department of the company, will be erected under contract by the Austin Company of Cleveland, and 1,000 tons of steel will be used.

Competitive bids were submitted for both welding and riveting in fabricating the steel, and by using welding it was found that $2,100 will be saved, or $2.10 per ton, over the riveting method.

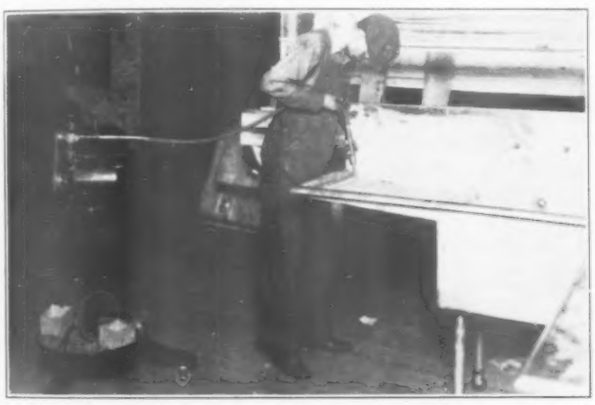
Hints for the Welder

WHEN YOU FIND a new way to do a hard job, or finish a particularly interesting weld, can you describe how the work was done? . . . . . Have you learned some little stunt every welder ought to know? . . . . . Write to us about these things . . . . . This department helps you welders to help each other. Write up your ideas any old way and just make rough pencil sketches . . . . We'll fix them up for publication.

Grinding Alleghany Metal Welds with the Flexible Shaft

By E. P. Grismer†

Much information is at hand about the proper ways and means of grinding welds on sheet metal. All of this material has dealt with all types of metal except the latest—Alleghany and other brands of stainless steels. There has been



Even a Small Amount of Reinforcement on Stainless Steel Welds Presents a Production Problem.

little information on this phase of sheet metal welding work.

Because of the newness of this metal many of the plants have not yet perfected their welding operations—this will come in time. The result is too much stock left after welding that has to be ground off. A small amount of this hard weld to be ground is a problem—but the welds as we have found them presented a near production impossibility.

The R. G. Haskins Company, 4636 West Fulton Street, Chicago, has recently worked out an effective method for grinding welds in Alleghany type of metals with flexible shaft equipment. One thing we have to contend with is unthought hardness of the weld. Another drawback is the fact that there is a very noticeable hardening of the metal at the weld when over-worked. The present run of steel rotary files are practically useless on this metal. The several abrasive wheel manufacturers were not ready with any real information as to the grit, grade or bond to be used in wheels, pencils and points for this weld. It was necessary to experiment with different abrasives and speeds.

We have come to the following conclusions—rotary files are out of the question. Wheels (4 in. x ⅜ in.) made in rubber or Bakelite bond of 24 grit are used for roughing at speeds of from 7,500 to 9,000 R.P.M. The finishing cuts are made with 4 in. x ⅜ in. or 4 in. x ¼ in. bond wheels of 60 grit, grade X at the same speed. If a very fine surface is required use 120 or 150 grit disk sanders and complete the polish with felt pads or cloth wheels and rouge.

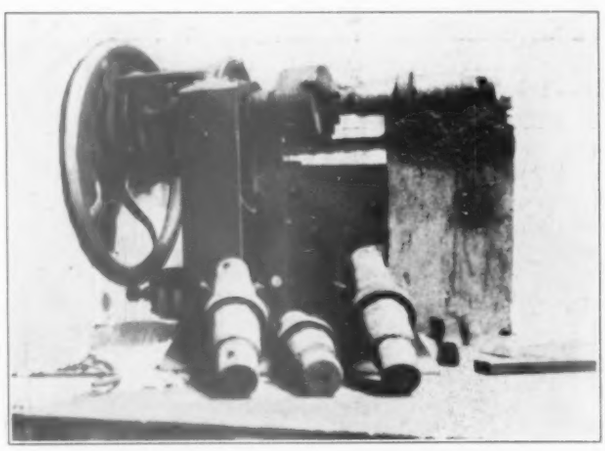
†*R. G. Haskins Co., Chicago.*

The welds in the corners are ground down with emery cones and pencils of the same grits as the wheels. All wheels, cones and pencils are operated in a grease-sealed ball bearing spindle. This handpiece is light in weight and very accurately made to withstand the high speeds. Special fixtures permit cutting in right angle welds with the 4 in. x ⅛ in. wheels.

These operations are being performed daily in large plants welding Alleghany metal with the Haskins HS-4 flexible shaft equipment. We can get a most efficient speed of 8,700 R.P.M. with this type of apparatus. For the ordinary flat larger welds in this material we use the heavier wheels of the same grits at a 3,500 R.P.M. speed. The slower speed is permissible due to the surface speed of the larger wheels. Such operations are performed with the direct drive ½ H.P. D-5 Sander, or the heavier DB-6 1 H.P. equipment. Both of these equipments can be equipped with a straight spindle or right angle head for straight wheels, cup wheels and disk sanding pads.

Building Up Worn Shafts Easier With a Jig

A practical home-made device for use in making more convenient and accurate the work of building up crank shafts is shown in the accompanying photograph. The unique parts, together with the unusual arrangement and construction of this home-made device are interesting.



Jig for Building Up Worn Shafts.

A piece of six-inch channel iron welded to the metal bench on which it rests constitutes the main supporting frame for the device. A small universal chuck from a lathe is used for holding the shaft to be built up. This is attached to a front wheel hub from a Ford car which is welded to the supporting channel iron. Reduction gears from an emery wheel perform that function of the device, while a Ford steering wheel is attached and acts as a friction drive wheel which is

propelled by the hook-up of a sewing machine motor with foot pedal switch control. The speed of the shaft being built up can thus be controlled to conform to the speed of the welding procedure, with no stopping necessary except to change welding rods, etc.

This unusual and practical piece of equipment is in use in the Armatage Welding Works, in Ventura, California. Mr. Armatage states that by the use of his home-made machine he can build up a shaft much more smoothly and accurately than by any other means. It enables him to turn out a true shaft which, when machined, has no flaws. Some recently built-up shafts (before machining process) are shown on the bench in the foreground of the picture.

All Classes of Patrons Demand Efficient Service

By Clement White

Patrons from rural territory, as well as from urban centers, are seeking efficient welding service, and show a disposition to investigate a firm's shop equipment before leaving their welding jobs. This is the experience of the Topeka Arc Welding Company, located at Topeka, Kansas. Topeka serves an unusually large rural territory, which, coupled with the fact that the Topeka Arc Welding Company has the most completely equipped shop in this section of Kansas, brings many difficult welding jobs to the firm.

"During recent months we have handled some unusually big welding jobs," explains C. L. Meinholdt, a member of the firm. "Many of these jobs required a lot of chiseling, which we did by hand. This was a very tiresome job, and wasted time, so in order to save time and give quicker service, we modernized our shop by installing an air compressor and a pneumatic chipping hammer. This equipment has greatly increased our efficiency, and pleases our customers because of the prompt service we can offer. As an example, a job was done the other day with the pneumatic hammer in 45 minutes, which would have taken about four hours by hand. This shows the use of modern shop equipment insures a big saving in time and money."

Competent welding service is a major factor in winning the goodwill of patrons, explains Mr. Meinholdt.

Several weeks ago the Topeka Arc Welding Company welded a big transmission on a Caterpillar 60 tractor.

"This job had been brazed by another firm, but the job didn't hold," explained Mr. Meinholdt. "We ran across some people who were down on welding, as it seems most every job of welding in which they had been interested was a failure. We accepted the job of welding the big transmission on the Caterpillar tractor only on the condition that if the job didn't hold, we were to receive no pay.

"We found there were six breaks in the case, which would have weighed in the neighborhood of 700 or 800 pounds if stripped. The entire job was chipped out and rebrazed, using our patented method of welding without preheating. About six hours were required to finish the job, which is much less than the time required to strip the casting and bring it to the shop. Our welding job held, and this customer now has a good opinion of welding. We can convince any patron that welding is a success. We built up our business by guaranteeing satisfaction."

New Application of Welding in Oil Field Work

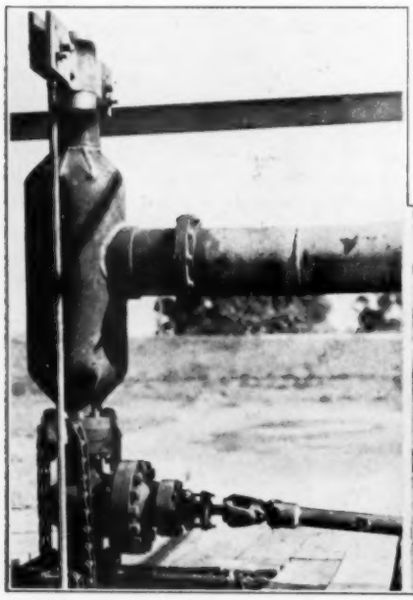
A very recent and valuable discovery for the use of welding in oil field work has been made in the Oklahoma City field in Oklahoma. The device, while simple enough in construction, and the application of welding in making it is nothing out of the ordinary, yet, oil-field welders and others familiar with "high-pressure" oil wells, will appreciate the practical use and economy of this home-made installation.

The device is termed a "sand cushion", a closeup view of which is shown in Figure 1. Its function is to reduce the abrasive action on connections and fittings of the sand and gravel in the gas and oil as it comes with terrific force from the wells containing excessive gas pressure. The cutting action of this sand in some of these high pressure wells in the Oklahoma City field has been so great in some cases as to necessitate the replacing of the pipe fittings at the top of the well every few hours. Thus the problem of eliminating this great expense remained practically unsolved until the idea of using these "sand cushions" was tested and put into use.

These cushions are constructed of 12½-inch casing (in this instance) by swaging and welding, as seen in the picture. Being inexpensive in both material and construction, these cushions can be replaced economically as they are worn through, thus eliminating the expense of installing new connections and fittings. Thousands of dollars are saved by the companies of this field in this manner every month.

Figure 1 also shows the device installed and in use at one of the wells in the Oklahoma City field. The location is in the north extension of the field, and the well is one owned by the T. B. Slick Co., Inc. Many wells in this field have a potential production of over 150 million cu. ft. of gas per day.

Figure 2 is another view of the well showing the installation of the sand cushion in the rig, together with the line carrying the oil to separator and storage or transportation lines.



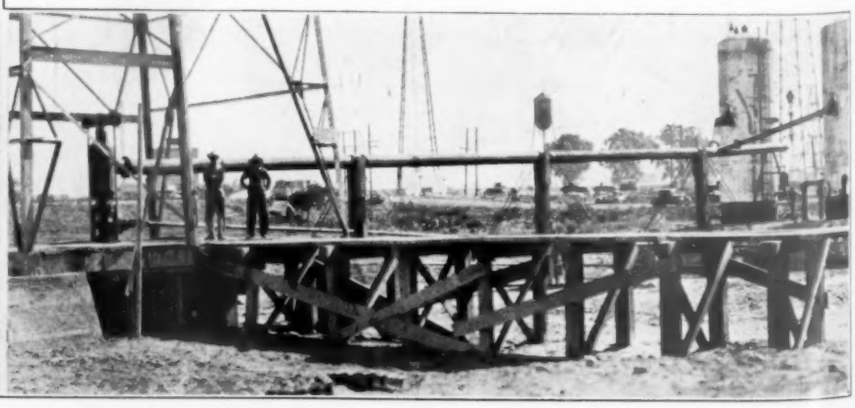


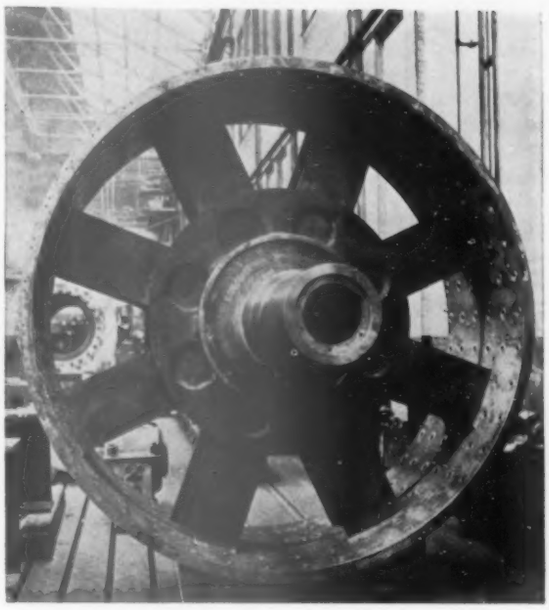
Figure 1. (Left) Welded Sand Cushion. Figure 2. (Below) The Complete Installation.

New Method of Welding Rotors Used by Westinghouse

In design the use of welding has progressed to the point where manufacturing methods have taken a place parallel to riveting and casting. The illustration shows an application where welding is used to obtain maximum efficiency of connections. This is a rotor for a ship propulsion motor, rating 13,250 horse power, 133 r.p.m. It is 148 inches in diameter and was designed to withstand exceptional vibrational stresses, distributing them uniformly throughout the weld with a minimum of stress concentration in both weld and welded members.

The rim is made of two plates rolled up and welded together. This simplified the manufacturing problem as the rim was too wide to be rolled in one section. Intermittent welding was used to weld the rim sections together. The arms are standard H-Beam sections. The beams were burned through the center of the web, making two T sections. These sections were then welded in place with a space axially between them so as to reduce the amount of rim overhang and increase the hub lengths.

It was found, from many tests, that the most efficient connection, where severe torsional vibrations are present, between the arms and the hub was made by the introduction of relatively thin plates between the arms and the main driving hub plates. This thin plate was welded to the arms by a circular fillet weld, this being the only connection between the arms and the main drive hub plates. The thin plates, in turn, are welded to the driving hub plates and to the hub spacing cylinder, all of which are bored out for the shaft.



Welded Rotor for 13,250 H. P. Motor.

During the welding of such a structure, welding stresses are set up which are removed by annealing.

Building a Job Welding Business

By W. Irving Brockson

I—Locating the Shop

THE location of the shop often determines the success or failure of a job welding business. Mediocre equipment and fair welding skill in a good location have a greater chance of success than good equipment and expert welding skill in a poor territory. Since location, when once selected, is the most difficult feature of a business to change, it is highly important that this factor be given the most careful study and thought in advance.

The Potential Volume of Business

The best location for a job welding business is the one nearest the largest potential volume of business. That statement is so obvious as to be trite, yet its influence on the profit or loss of the venture is all too frequently underestimated.

When a modern grocer starts out to chose a location for a new store he makes a very careful check of the number of people who live in a given district, their average income, habits of buying, competition and other factors. The "up-and-coming" gasoline station manager tries to "spot" his stand at the junctions of the most important highways where the largest number of gas consuming vehicles pass. Before he actually decides on a site he collects accurate figures on traffic passing several possible locations. The welding shop owner should be just as thorough as the grocer or the gas station man in gathering his facts and just as careful to settle at the busiest "Industrial Crossroads."

Types of Industries

In deciding what the possible business is in a given area, an accurate survey should be made of the types of industries existing in the district which can logically be served. Are they the kind which require welding? Are they using welding now? If they can, but do not use welding, what are the chances of selling them on its value? Obviously, a metal working concern is more likely to be a prospect for a job welding shop than a wood working company. Also, any manufacturing plant is a far more likely prospect than a mail order house. A knowledge of the raw materials entering any plant, as well as the finished product going out, will furnish a good insight into the general possibilities for welding.

Industrial Trends in the District

Another important thing to consider is the trends of the major industries in the district. Is the area improving or going backward as a possible market for welding service? For example, we are told that there is a trend toward less textile manufacturing in New England and more steel manufacturing in the Chicago area. Assuming, for the sake of comparison, that each of these industries represents an equivalent amount of potential welding business, the job shop in New England would be likely to find a diminishing market and the Chicago shop an enlarging one.

New Industries

A further point to study is the new and growing establishments in the territory. Are these industries logical prospects for welding? If they are, what is the likelihood of their growing to large proportions? For instance, the radio manufacturing business a few years ago was a small industry offering a bright future. Today the aviation industry seems to offer good chances for rapid growth. Any new company starting in a given district should be studied not only as to whether welding fits into its work but as to the possibilities before the industry which it represents and the probabilities of the local unit being able to keep pace with the industry as a whole.

Welding Equipment Owned by Prospects

An additional factor worth investigating is the welding equipment maintained in and operated by the industries in the territory for their own use. A certain establishment may be a big user of welding, both for maintenance and production, yet if it has its own welding equipment and hires its own welders it offers little chance for the job shop.

Important Highway vs. "Alley"

Where at all possible it is advisable, as intimated in a preceding paragraph, to locate on important and much traveled highways or streets. Such a location makes it easier for prospects to bring work to the shop and for the plant to be seen by a great number of people. Rents may be cheaper on some "alley" or side street, but what is gained on that score is more than lost by lack of publicity and prestige. A well kept shop on an important street has the air of a manufacturing plant and gives the impression of success and professional skill. Whereas the "back-door" location tends to give the impression of financial unreliability and "one-horse-ness." To be sure, there are hundreds of successful "side-alley" welding concerns, but even these successful ones would, in the vast majority of cases, do better in more prominent locations.

What Is the Competition?

Competition, like the poor "is always with us." Regardless of how inferior a competitor may be he gets some work as long as he is in business and every job he gets is that much less for the new establishment. Don't underestimate how firmly intrenched the old established shops may be with their trade. It is usually easier for an old shop to hold the patronage of a customer than it is for a new shop to go in and take the business from the old source.

Get as much information as possible about the amount of business competitors are getting and from whom they are getting it. Try to find out how they stand in the estimation of their important customers. Other things being equal there is more chance of a new welding shop succeeding in a given territory if there is only one competitor, than if there were three. Of course, the new shop may have far better equipment, more skillful welders and more aggressive sales methods and thereby stand a good chance of outdistancing one or more of the established houses. Nevertheless this whole matter needs to be given a most serious and thorough-going study before any location is finally selected.

Success Rewards the Conscientious "Chooser"

Naturally, these are but a few of the factors to consider in locating a welding-service business, yet their influence upon success is frequently underestimated. Of course, such things as rent, length of lease, condition of building, suitability of building to the industry, lighting conditions, heating, cost of current and other things must be studied. It may be said that gathering all the information suggested in this article would involve much time and tedious work and that many points could not be covered with absolute accuracy. That is true, but all factors mentioned do have an influence on the success of the business and it is far better to make an honest effort to find out about them in advance than to ignore them and run the risk of their causing failure later. Besides, they are only points which any modern business manager would look up. The shop located after all these things have been considered and weighed has much better chances to win than the one set up hastily "on a hunch."

Novel Home Ornaments Made by Welding

Two specimens of the application of welding in home-made ornamental iron work are shown in the accompanying photographs. Figure 1 shows a floor lamp made by artistic work of running beads of electric welding along the pipe forming the stem of the lamp. Ordinary welding rods are also used in a similar manner to resemble twining vines. Other ornamental designs of roses, leaves, etc., are also welded on for added artistic effect. The upper section is an aluminum casting with a piece of boiler plate on top. The design shown is obtained by cutting out with the oxy-acetylene cutting torch.

Figure 1. (Left) An Attractive Floor Lamp Made of Scrap Metal. Figure 2 (Below) This Bronze Lamp Is an Ornament to Any Room.

Figure 2 is a bridge lamp of bronze. The parts used are unique and interesting. The base is an old used pump valve, to which is welded an old brass fire hose nozzle as the main stem of the lamp. Beads of electric welding on the sides represent twining vines. Metal flower buds are also welded to the sides for added beauty. The top section of the lamp is a small pump valve welded on.

These ideas were worked out by C. E. Rimmer, welding foreman for the Wilshire Oil Company of Sante Fe Springs, California.

Pipe Welded Electrically by New Process

A Norwegian engineer conceived the idea of displacing the old furnace practice in making welded pipe, with electrical heating, keeping the advantages of the low cost material; that is to say, hot rolled bands or skelp with natural edges and scale, but eliminating the disadvantages of uncertain and uncontrolled heat application, uncomfortable working conditions and undetermined quality of weld, together with excessive scrap loss and labor.

As finally worked out after eleven years of laboratory and experimental work, the process embraces complete continuity from a long roll or coil of strip to the final sizing and automatic cutting off of exact length of the finished pipe. The welding is performed by a gradual application of heat through a series of electrodes riding on the seam clefts at a gradually increasing temperature until the edges are in a plastic or welding state, when pressure is gradually applied in the degree that has been pre-determined as giving the best results. Since the heating takes place in the entire body of the metal, the product is uniform in temper and is therefore suitable for subsequent bending or threading operations, as

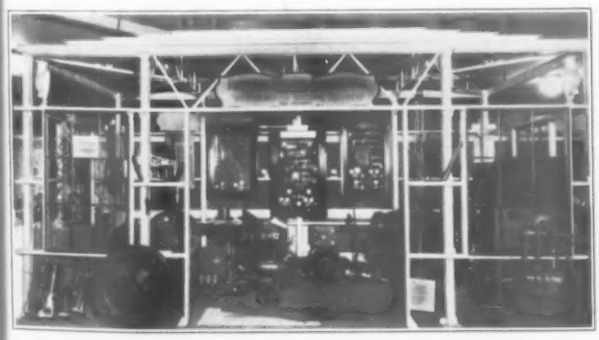
in the case of furnace welded pipe. Up to the present time equipment for carrying this process into effect has been small and inexpensive; but the range of sizes and gauges are now being extended beyond 2½ in. diameters, and no reason is seen why much greater sizes cannot be manufactured in the same way. The process has been patented in several countries, and licensees thereunder are now operating in England, France, Belgium, Norway, Denmark and Poland. Before the end of the year it is expected that practically all other European countries will have adopted this method. The American rights are controlled by Julius L. Sussman of 233 Broadway, New York City, who has recently returned from abroad.

Electric Welded Display Booth for Arc Welder Exhibit

A novel and interesting exhibit which attracted much attention of visitors at the recent Metal Congress, held in San Francisco, was a small structural steel building, fabricated and constructed entirely by electric welding. This small building comprised the booth which contained and displayed the electric welding equipment of the Westinghouse Electric Company, under the presentation of their San Francisco distributor, The Roberts Welding Equipment Company.

The structure was ten feet wide by twenty feet long, with a height of nine feet and six inches to the bottom chord of the trusses. The roof was of the hip truss design and carried steel purlins. The side framing consisted of steel channel eave struts and girts. The front of the building had a large opening for the door, (for convenience of visitors), and at each side and end of the building Fenestra Steel sash were welded in place. When completed the building was painted an aluminum color, which gave it a very attractive appearance.

The time required for fabrication and erection of the building was less than forty-eight hours, including all labor and the time of the welder. Erection and welding after assembly at the auditorium required only about four hours, the trusses and much of the roof having been fabricated and welded in the shop and moved to the auditorium by sections for assembly.



Welded Structural Building Exhibited at Western Metal Exposition by Roberts Welding Equipment Co.

This interesting display of structural welding was designed by the Allied Welders Association, which is an organization recently formed in San Francisco to assist the welding shops in the expansion of their business to contracts covering structural steel welding. The organization also provides an engineering department, which service is so necessary for this class of work. The fabrication and erection was under the direction of the J. Edmund Davies Co., of San Francisco, and also the above mentioned organization known as the Allied Welders Associates.

In the welding operations of the structural exhibit building, a Westinghouse 200-amp. welding machine was used, and the building was welded throughout with Westinghouse "Flex Arc" welding rods. Demonstrations were made daily of automatic welding of ship deck plate.

Welded Construction Advertised at Less Cost

A striking advertisement appearing in recent issues of the Wall Street Journal, the Chicago Journal of Commerce, and in the daily newspapers of Detroit, St. Louis, Pittsburgh, and Cleveland, calls attention to the fact that the Austin Company, with headquarters at New York City, are now offering a noiseless welded structural construction at a lower cost than riveted construction. The announcement points out that just about a year ago the Austin Company advertised that they were offering welded steel construction at a cost comparable with riveted construction, but they have developed procedures to the point where they are now prepared to design and build welded structures at lower cost. The advantages of welding as featured in this advertisement are as follows:

1. Less cost.
2. Greater strength and rigidity with fewer component parts.
3. Increased speed in construction.
4. Silent construction.
5. Practical elimination of the inherent limitations of riveted joints and the need for correcting fabrication errors in the field.
6. Improved appearance.
7. The most up-to-the-minute method of building known to the scientific world.

It is stated that the Austin Company during the past nine months has designed, fabricated and erected several thousand tons of electrically welded steel.

Over 300 Attend Conference in Cleveland

Attendance reports received from the welding conference which was held at the Case School of Applied Science, Cleveland, Ohio, February 19th and 20th, shows a total registration of 355. 233 of these came from Cleveland; 86 represented thirty cities in Ohio outside of Cleveland, and 34 represented seven states outside of Ohio. There were two registrations from foreign countries. These figures do not include any members of the faculty or student body of the Case School. Following is a list of the papers and speakers on the program:

Short Educational Conferences
W. E. Wickenden, President, Case School of Applied Science

Thermit Welding
J. H. Deppeler, Chief Engineer, Metal and Thermit Corporation

Oxy-Acetylene Welding and Cutting
F. J. Maeurer, Engineer, Air Reduction Sales Company

Atomic Hydrogen Welding
P. I. Doty, Sales Engineer, General Electric Company

Arc Welding, and Welding with Electric Arc Flame Torch
K. L. Hanson, Engineer, Northwestern Mfg. Company

Summary of Welding Processes
F. T. Llewellyn, Engineer, United States Steel Corporation

Metallography of Welding
H. M. Boylston, Professor of Metallurgical Engineering, Case School of Applied Science

The Relation Between Quality and Economy in Welding Operations
L. C. Monroe, Service Department, The Welding Engineer

Electrical Resistance Welding
M. L. Eckmann, Research Engineer, Federal Machine and Welder Co.

The Use of Welded Steel in the Construction of Machinery
A. F. Davis, Vice President, Lincoln Electric Company
Discussion opened by
Wm. G. Wehr, General Superintendent, Cleveland Crane and Engineering Co.
Oxwelding for Modern Piping Services
F. C. Outcalt, Development Engineer, Linde Air Products Co.
Designing for Welding
E. W. P. Smith, Consulting Engineer, Cleveland
Structural Steel Welding
G. D. Fish, Consulting Structural Engineer, Westinghouse Electric & Mfg. Co.
Discussion opened by
R. K. Randall, President, Cleveland Welding School
J. J. Bowman, Engineer, Aluminum Company of America
Trend in Transmission Pipe Line and Compressor Station Welding
W. R. Ost, Engineer, Air Reduction Sales Co.

Hold Welding Symposium in Cleveland

An oxy-acetylene and electric welding demonstration of aluminum, monel metal and pure nickel was sponsored by Williams and Company, Inc., at their Cleveland warehouse, 1748 East 22nd Street, Cleveland, Ohio. These meetings were held on Friday afternoon, February 13th and Saturday morning and afternoon, the 14th.

The speakers at the sessions were Mr. Fred Huston and Mr. J. Bowman. Following the talks by Mr. Huston and Mr. Bowman, expert welders from The U. S. Aluminum Company and International Nickel Company demonstrated. The attendance at the two sessions was approximately six hundred and keen interest was displayed by those present in the uses of monel and aluminum, sheet and cast, and the possibilities of fabricating these metals using arc welding and oxy-acetylene welding as the method of fabrication.

A most interesting display of welded samples of monel, nickel, duralumin, sheet and cast aluminum was displayed on large boards at the entrance to the lecture hall. The meeting was attended by a varied group and faces of the best known welders in Cleveland and members of the engineering profession were readily recognized in the group.

Mr. J. H. Penske, District Manager of Williams and Company in Cleveland and "Jack" Carbis sponsored this series of most successful meetings.

Victor Welding Equipment Co. to Buy Kimball-Krogh Pump Co.

Victor Welding Equipment Co. are about to purchase and take over the old established firm of Kimball-Krogh Pump Co., manufacturers of pumps who have been in the market for nearly 60 years and have enjoyed a very large business on the west-coast.

With principal plant at Los Angeles, a smaller plant in San Francisco and warehouses and agents throughout the United States, the total distributing facilities and systems togther with those of Victor Welding Equipment Co. will create a very complete distribution outlet.

It is proposed to create a new company under the probable name of Victor Equipment Co. which will operate as divisions, the Kimball-Krogh Pump and the Victor Welding Equipment division.

The management of the Victor Equipment Co. will be in the hands of L. W. Stettner as President, Mr. E. L. Mathy as Vice-President in charge of Sales Promotion, Advertising and Publicity, and Mr. W. S. Fulwider as Secretary.

Structural Welding Specifications Covered in Booklet

A booklet entitled "Specifications for Structural Arc Welding" has recently been prepared by the Electric Welding Company of America, located at 744 Court Street, Brooklyn, New York. These specifications cover shop fabrication and field welding, and include five pages of detailed drawings showing column and beam connections, column connections and splices, framing details, truss connections, etc.

Lincoln Booklet on Prize Competition

The Lincoln Electric Company, Cleveland, Ohio, have prepared an attractive booklet of information concerning the Second Lincoln Arc Welding Prize Competition. In it the purpose of competition is explained and the prizes ranking from $7,500 to $100 are listed. It is pointed out that the papers will be judged according to the amount of saving in the first cost and upkeep resulting from the application of arc welding. There follows a carefully prepared outline of mandatory requirements covering eligibility; relation with the subject; the subject matter; method of treatment; limitations and method of presentation. Explicit directions are given for delivery of the paper to the Lincoln Electric Company, including the time limit for mailing, which is October 1, 1931.

Purdue Announces Conference on Management

Announcement has been received from the Engineering Extension Department of Purdue University, Lafayette, Ind., that a two-day Educational Conference on Management and Personnel will be held at the University on April 10th and 11th. The Friday program will be devoted to problems of Management; the Saturday forenoon program will be devoted to discussion of Personnel Problems as they apply to Management; Saturday afternoon will be given over to a round-table discussion of the general subject. Invitations have been extended to plant managers, department heads and those dealing with management and personnel problems.

Delivering Pipe to the Field in 600-Foot Lengths

Extending the idea of welding pipe together into 40-foot lengths for delivery to the field in order to reduce the amount of field welding in the construction of pipe lines, the A. O. Smith Corporation, Milwaukee, Wisconsin, is now giving considerable publicity to the suggestion of welding together longer lengths at convenient points so that the pipe line constructor or contractor can have the pipe delivered alongside the ditch in 300 to 600-foot lengths with all bends in position ready to tie in.

Kansas City Oxygen Gas Co. Changed to Puritan Compressed Gas Corp.

Notice has been received that the corporate name of the Kansas City Oxygen Gas Company, Kansas City, Mo., has been changed to Puritan Compressed Gas Corporation. The change was made effective March 2, 1931. For some years one division of that company has used the Puritan trade mark, and since there have been a number of activities taken on by the company since the early days of its organization when it made oxygen gas only, the directors consider that the new corporate name is not only more comprehensive but more appropriate. There has been no change in officers, personnel or policy. The company manufacturers oxygen, hydrogen and acetylene and sells a complete line of oxy-acetylene welding and cutting apparatus, supplies and materials. It has two plants in Kansas City with branches at Chicago, St. Paul, Cincinnati, St. Louis and Detroit.

Sight Feed Sales Co. Organized to Market Generators

The Sight Feed Sales Company, with headquarters at Norwood Building, Dayton, Ohio, has been organized to sell and distribute the products of the Sight Feed Generator Company of West Alexandria, Ohio. Selling will be conducted through the usual sales channels, that is, wholesalers to dealers to users. The products of the company include a line of acetylene welding generators, trucks and acetylene flood lights. Mr. W. W. Boes is president of the new company.

Lotan Research Corp. to Distribute Warner Products

Warner Engineering Corporation, of Pomona, Calif., manufacturers of "Weco" electric torch, have appointed the Lotan Research Corporation, Cleveland, Ohio, as distributors for Michigan, Pennsylvania and Ohio. Information recently received from the Warner Engineering Corporation indicates that they have been successful in using the arc flame for welding extruded metals. They have also been successful in making strong welds in aluminum alloys with their apparatus.

Correction

In the February issue of The Welding Engineer there appeared a short article regarding the welding activities in the refining plant of the Del Rey Oil & Refining Company in southern California, with a photograph of this work carrying a title which speaks of the use of Tube Turns. This has caused some confusion because Tube Turns used in this plant are actually not visible in the photograph which was used for illustration.

Metal X-Ray Service Offered in Chicago District

X-Raying steel, iron and metal up to a thickness of 4½ inches, is the service rendered to industry by the newly organized Claud S. Gordon Steel X-Ray Laboratory of Chicago. Patterns, tools, dies, castings, raw material and all shapes and sizes of steel and iron will undergo the microscopic scrutiny of this most powerful of all X-Ray equipment. Inherent defects and bugs will be uncovered just as in the X-Raying of teeth or parts of the human body, a science highly developed in the medical and dental professions.

The Gordon Company is making this new service available to all industries using steel in manufacturing. This steel X-Ray Laboratory is the only one of its kind west of New York. "Metallurgical radiography" is the scientific term applied to this new science. The General Electric X-Ray Corporation of Chicago (formerly the Victor X-Ray Laboratories) furnished the special apparatus required for this huge laboratory project.

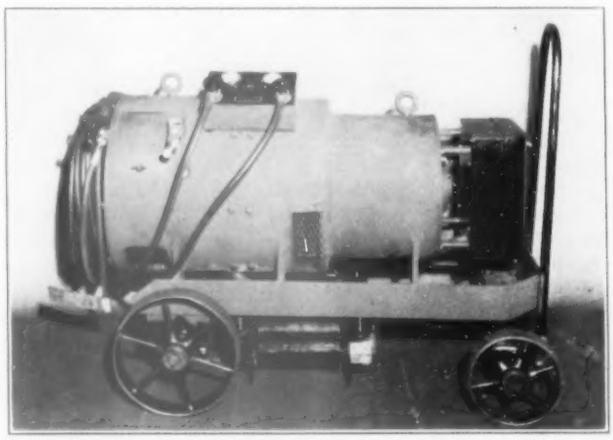
The equipment of the X-Ray is able to handle any size piece of metal from the smallest to the largest casting or pressure shell.

The new laboratory is located at Western Avenue and 15th Place, Chicago, with general city offices at 708 W. Madison St., Chicago, and a branch at 1988 E. 66th St., Cleveland, Ohio.

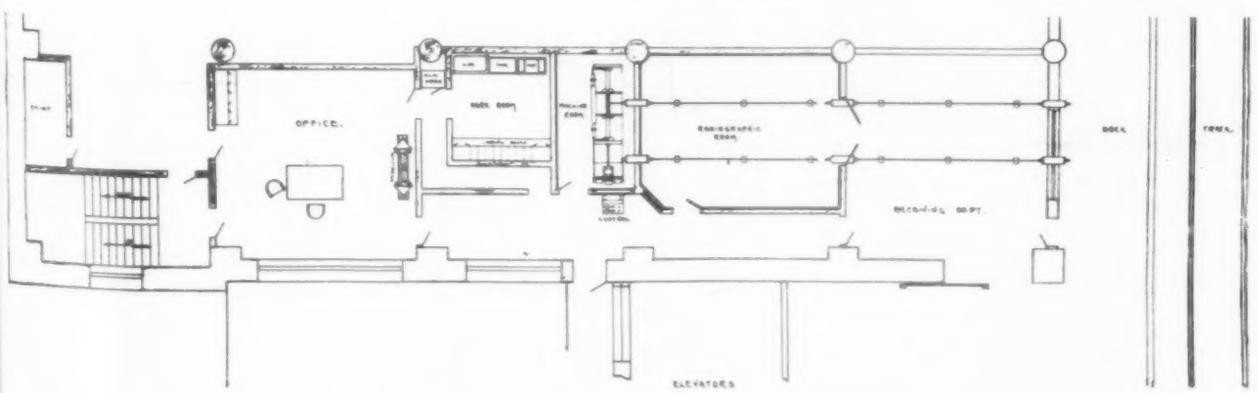
A railroad siding and switch-track located in the Midland Warehouses at Western Avenue and 15th Place, Chicago, makes it possible to handle any size job speedily and efficiently, by having it delivered to the tube-room of the Gordon Laboratory direct from freight cars.

Burke Announces Improvements in Arc Welders

Further improvements in design and construction of Burke arc welders have recently been announced by the Burke Electric Company. One of the outstanding features of this equipment, featured in recent bulletins, is the simplified micrometer control of the current, providing simple adjustment of the current by mechanical means. This is accomplished by a calibrated lever which mechanically shifts the brushes of the generator to various positions. The correct position for the best current position is shown on the dial mounted on the generator frame. The welding current is regulated without changing the welding characteristics of the generator throughout the range of operation, except to increase or decrease the volume of current in the arc. The open circuit voltage remains the same throughout the entire range. It is pointed out that the net result of this self-adjustment to varying arc length is that the operator does not have to alter the mode of handling the arc when the volume of the current is changed. The illustration shows one of the latest types.



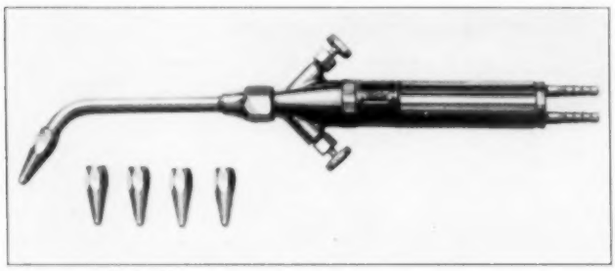
The New Burke Arc Welder.



Plan of Claud S. Gordon Steel X-Ray Laboratory in Chicago.

New Aircraft Welding Blowpipe

The Type W-107 Welding Blowpipe has been added to the Prest-O-Weld line by The Linde Air Products Company, as an improved sheet metal blowpipe to be handled through Prest-O-Weld distributors. While this new blowpipe has been designed primarily for airplane fuselage welding, it is suitable for light welding work of all kinds. In design and appearance it is somewhat similar to the Oxweld Type W-15 Blowpipe, but it operates on the medium pressure principle.

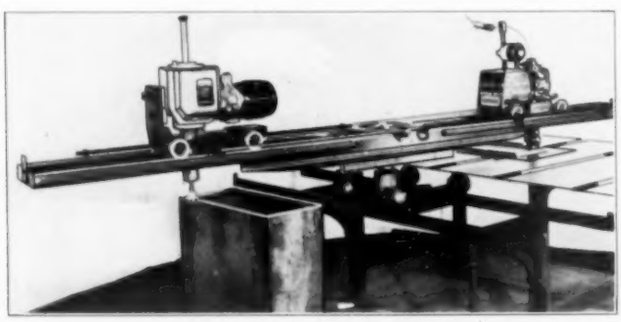


Prest-O-Weld W-107 Welding Blowpipe.

The gases mix immediately in front of the handle and the oxygen and acetylene valves are so located that they can be readily adjusted with the thumb and forefinger of the hand which holds the blowpipe. The blowpipe is 10½ in. in length, weighs only 10 oz. and is perfectly balanced. Six different size tips are available for use with this blowpipe although it is furnished as standard with 5 tips, Nos. 2 to 6 inclusive. The blowpipe possesses many advantages in operation as it is small and light so that it can be readily handled where fine and accurate work is required. The complete Prest-O-Weld W-107 Welding Outfit includes not only the blowpipe but a Prest-O-Weld Type R-106 Oxygen Regulator, Prest-O-Weld Type R-107 Acetylene Regulator, 2—25 ft. lengths of ⅜-in. Hose, 1 Pair of Fibre Spectacles, 4 Hose Clamps and Instruction Book.

Arc Welding Head Automatically Guided by New Machine

The General Welding & Equipment Co., Boston, Mass., have brought out a series of machines to guide electric arc welding heads automatically over any regular or irregular line. With the fast expanding fabrication and mass production, covering all kinds of shapes, machines which can follow any line exactly, at a uniform speed and with one single operation, will obviously be a big step forward.



GEWE Control for Automatic Arc Welding Head.

The illustration shows one type of such a machine with a Lincoln Electric Co., Automatic Electric Tornado Head for welding heads in tanks. These tanks have formerly been welded with straight line machines which has meant four different settings for the four sides.

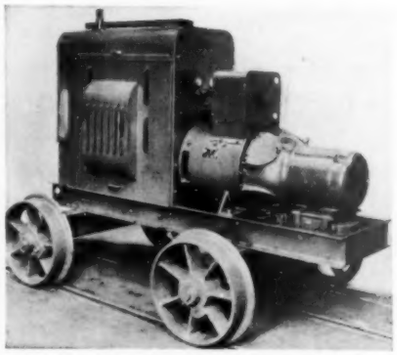
The time needed was nine minutes, of which, six minutes were used for resettings. The shape welding machine does this work with one single setting, which means a considerable saving in time. Four of these shape welding machines are supposed to weld about 2,500 tanks per week. The speed of welding (1/16 in. stock or ⅛ in. at the top edge) is 25 linear inches per minute. This type of machine was designed by Dr. A. Krebs and Carlos Krebs.

New Spot and Projection Welder by Federal

The Federal Machine & Welder Company, Warren, Ohio, are featuring the Senior No. 2 spot and projection welder which is their latest design for high speed production in sheet metal fabrication. A feature of this new machine is that the main housings are fabricated and welded entirely of structural steel. At the same time, it has been designed so as to retain the lines and contours of the cast iron housings previously used. The manufacturers state that by changing from cast construction to fabricated steel, the strength and durability have been increased, while the weight has been reduced about 1,500 lbs. The production cost and shipping cost have also been reduced.

Operating features of the new machine include a variable stroke head and a hand dial motor control governing a four-speed motor. It has a speed range of from 15 to 130 welds per minute, depending on the setting of the gears and the thickness of the material. A close coupled secondary circuit is secured by designing the transformer so that the front face becomes the face of the machine against which the lower arm clamps.

Flanged Wheels Standard Equipment on "Flexarc" Set



Westinghouse Gas Engine Driven Welder with Flanged Wheels.

A gas-engine driven welding set equipped with flanged wheels for track service is offered by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. This "Flexarc" welder is a 2,000 ampere, single operator, self-contained unit, especially suitable for construction work beyond the reach of power lines. The model is available for service on railroad tracks or in mines.

New G. E. Heavily Coated Electrode

The General Electric Company announces a new heavily coated electrode, designated type R, for quality welding. This particular type of electrode is composed of .13 to .18 carbon steel covered with a heavy coating of cotton braid impregnated with an arc stabilizing flux, and will be available in diameters from ⅛ to ⅜ in. by 18 in. length. It is claimed that metal deposits of this electrode will have high tensile strength and will produce a homogeneous structure resulting in a ductile weld. This is caused by the fact that, during the arc transference period, the metal is in a protective atmosphere because the electrode itself burns away quicker than the coating and excludes those elements always prevalent in atmosphere which cause some undesirable results when the use of an uncoated rod is used. According to the manufacturers extreme arc stability and high arc voltages permissible from this type of electrode produce an unusually high speed of welding for certain applications. The new electrode is expected to be of particular value in the field of pipe line welding where speed and ductility are essential requirements.

American Chain Products Described in Booklet

A pocket size booklet which shows a list of the products of the American Chain Company, Inc., and Associate Companies, has just been issued.

As stated in the foreword, a perusal of the pages of this booklet indicates the broad field of manufacturing activity in which this group of companies is engaged. The group, which has become known as the ACCO Industries, includes the following companies—American Chain Company, Inc., American Cable Company, Inc., Andrew C. Campbell, Inc., Ford Chain Block Company, Hazard Wire Rope Company, The Highland Iron and Steel Company, The Manley Manufacturing Company, Owen Silent Spring Company, Page Steel and Wire Company, Pratt & Cady Company, Reading Steel Casting Company, The Rubber Shock Insulator Corporation, Wright Manufacturing Company, Dominion Chain Company, Limited, of Canada, as well as British Wire Products Company, Limited, and Parsons Non-Skid Company, both of London, England.

"Flotite" Solder for Aluminum and White Metals

A new solder for aluminum and the so-called "white metals" has recently been put on the market by the Pittsburgh Metals Purifying Corporation. It is marketed under the trade name of "Flotite." Among its varied uses is the salvaging of aluminum and white metal die castings, architectural fabrications, the repair of automobile bodies, crank cases, door handles, radiators, kitchen utensils and household appliances. The manufacturers claim that it makes joints which are stronger than the metal itself and that its color is so nearly identical to the parent metal that after a job has been dressed, it is practically impossible to locate the break. The melting point of the solder is low, it flows freely and it can be applied with a soldering iron or with an open flame torch.

News of the Industry

At the recent annual meeting of the stockholders of Innis, Speiden & Company, Mr. G. S. Hamilton was elected a director as an additional member of the Board. H. G. MacKelcan, C. C. Wickstead and C. L. Speiden were elected vice-presidents. The president, W. H. Sheffield, stated that in spite of the general depressed conditions, the company's business did not fall off as much as the general averages, and that it reflected the Board's attitude in expressing pride in the company's ability and policy of maintaining salaries and of keeping all of the employees in their jobs. Further plans for increasing the company's sales, distribution and services are being completed, and their organization is being perfected to that end.

Standard Steel & Wire Company, Greensburg, Pa., announce the appointment of five new representatives as follows:

Chicago Steel Service Co., 3912 S. Ashland Ave., Chicago, Ill.

Chester F. Gailor, Inc., 50 Church Street, New York, N. Y.

W. H. S. Batheman & Co., 1281 Broad St. Sta. Bldg., Philadelphia, Pa.

Cutter, Wood & Sanderson Co., 222-232 Third St., Cambridge, Mass.

McGirr Sales Company, 1026 Bank of America Bldg., Los Angeles, Cal.

All-welded railroad cars are increasing in use in Germany according to a recent news item in The Iron Age, which also shows a photograph of an all-welded car for the transportation of refuse and waste in cities. The savings claimed are 20% of the weight and 15% of the cost.

Friends of C. R. Pollard, who was associated with the Sales Department of the Alexander Milburn Company for a number of years, will be interested to know that Mr. Pollard has been a patient in the Baltimore Eye, Ear and Throat Hospital for several weeks on account of an operation on his eyes. He expects that it will be necessary to remain in the hospital for two or three weeks after the operation.

A letter from the headquarters of Harris Calorific Company, Cleveland, Ohio, says that Lorn Campbell, Jr., President of the company, is finding human nature running true to form in Cuba in spite of the low price of sugar, which is selling at 1½c a pound. "Taxes are high, and a few bombs were in evidence," says the letter, "but they bought 'Red Heads' and Harris low pressure equipment." A very satisfactory connection was made with an outstanding firm there to act as Harris distributors on the island.

It is reported that patents on a number of designs and processes for the application of welding to the manufacture of steel building material for residences have been obtained by the Scullin Steel Company of St. Louis. These materials include floors, walls, window sash, frames, etc., and it is said that the company soon expects to start manufacturing them.

At the Mid-Western Engineering & Power Exposition, which was held in the Coliseum, Chicago, during the week of February 10th, welding equipment and materials were exhibited by American Brass Company, Linde Air Products Company and Tube-Turns, Inc.

What is said to be the first steel ship built in the United States without rivets is a new tanker now being constructed by the Atlantic Refining Company in the yards of the Sun Shipbuilding Corporation, Chester, Penn. This is a 200-ft. ship with 7,000 barrel capacity and has an all-welded hull.

Ira S. Bushey & Sons, Brooklyn, N. Y., have a contract for the construction of two welded barges which will require approximately 200 tons of steel.

A Pipe Manufacturing Department has been recently organized in the Middletown Division of the American Rolling Mill Company with C. C. Clarke as superintendent. A special department of the Sales Division has been set up for the sale of spiral welded pipe, with Mr. R. C. Beam as manager.

Rights for the use of the Kjekstad patented truss weld and reverse channel systems of ship and barge construction have been obtained by United Dry Docks, Inc., 11 Broadway, New York City. Kjekstad, inventor of these systems of boat construction, is now connected with the United Dry Docks Company as consulting engineer. These systems have been used to a considerable extent in the construction of a variety of boats, and it is reported that the first ship built under this system has been in use for nearly three years with a record of unbroken operation, although it has figured in collisions and groundings.

The welding fraternity in Australia now have their own welding movies. At a meeting of the Australia Welding Institute held February 26th, these movies, which show the electric welding of various structures in Australia, were presented and the operations were described by A. R. Moon.

The Southern Counties Gas Company of California recently completed the construction of a 33 mile 16-inch gas welded pipe line running from the More Lease of the General Petroleum Co., near Goleta, to the company's terminal station at Ventura. Also three miles of 12-inch line was completed running from the above line to Santa Barbara.

B & A Welding & Machine Co., Beaumont, Tex., has been organized with George E. Bryant, president, George E. Bryant, Jr., vice-president and L. C. Akin, secretary-treasurer and general manager to operate a welding and machine shop at Kilgore, Tex., in new East Texas oil fields. Company officials are owners of the Oil City Brass Works at Beaumont. A shop building, 50x100 feet, is being constructed at Kilgore.

Caldwell Welding & Machine Works, Houston, Tex., has moved from 1911 Franklin to 1504 Caroline St. Automotive welding will be featured. Cecil Caldwell is manager.

Houston Iron Works, Houston, Tex., has changed its name to Humble Welding & Specialty Works and will make a specialty of welding for oil field and marine work. H. Rodrigo is president and general manager of the company.

Gessner-Groh Electric Welding Co., New Orleans, has announced its dissolution.

H. Bliebler, owner and manager of a welding shop featuring general welding and ornamental iron work in Palo Alto, California, reports the recent purchase and installation of a new 200-amp. portable Westinghouse electric welder. The shop is located at 744 High St. Mr. Bliebler attended the Western Metal Congress in San Francisco last month.

F. G. Hackley and F. F. Parker, of Gilroy, California, recently purchased the welding and blacksmith shop formerly owned by Chas. H. Pierce, and are now operating the shop under the name of Hackley and Parker. Lathes and other machine-shop equipment have been added to the plant by the new owners, who in addition to regular welding and forging work, will feature general machine work with special attention paid to electric motor repair work. Mr. Hackley and Mr. Parker have had 25 years of experience in this line of work, having until a short time ago been connected with the Pacific Portland Cement Co.'s plant shop at San Juan Bautista, Calif.

At the February meeting of the Portland, Oregon, section of the American Welding Society at the Multnomah Hotel, a discussion was given on the various railway economies developed through welding.

Carl's Supply & Machine Works, Muskogee, Okla., successor to Carl's Machine Shop, has moved to new building at 207-209 E. Broadway, across the street from its former location. It specializes in welding and machine work, both heavy and light, also the manufacture of various industrial specialties, including a light type airplane motor. Carl J. H. Grunwald is sole owner and manager.

The Ventura (California) High School has recently opened evening classes for instruction in welding. These classes which will cover instruction in general shop welding and also plumbing welding work, are under the supervision of Mr. William Dirks, welding foreman for the Ventura Fuel Co. About 35 students have thus far enrolled for instruction. Mr. Dirks has had eleven years of experience in welding, a good portion of which time he was associated with the Southern California Gas Company.

R. O. Giffin, of Goleta, California, has recently taken over a welding shop in the Elwood oil field, which was formerly controlled by the Paco Corp. Mr. Giffin will operate the shop under the name of the Western Welding Co., and will feature general oil field welding work of all kinds, the shop, of course, being equipped for both gas and electric welding.

A test of a new welding fuel known as Hellam gas, which has been on the Seattle market for the past few months, was made at the plant of the Commercial Welding Company, Seattle, Wash., before state and city fire and boiler officials as well as representatives of insurance firms.

Evidently the "Verson" Allsteel punch press, forging press, etc., which were described in a recent issue of *The Welding Engineer*, are finding a good market. A new corporation known as the Allsteel Press Company has been organized to manufacture this complete line of welded equipment. The personnel, formerly associated with La Salle Machine Works of Chicago, is in complete charge of management and operations. Larger quarters have been acquired for presses for all purposes and in capacities from 25 to 2,500 tons which are now being supplied. The new company announce that it is definitely confined to steel construction.

The National Oxygen Company, with headquarters at 29 S. LaSalle Street, Chicago, and plants in several cities in the central states, have recently moved their executive offices from the seventh floor to the sixth floor at the same address, the move involving the use of about twice as much floor space as was formerly occupied.

The interests of the John Woods Manufacturing Co., of 2146 E. 25th Street in Los Angeles, Calif., manufacturers of automatic and non-automatic domestic water heating equipment, have recently been acquired by the Rheem Manufacturing Co., of South Gate. Stock and plant equipment are being moved to the new plant of the Rheem Mfg. Co., which was recently completed and put into operation. Practically all of the welders and other employes of the John Woods Co., will be transferred to the new company, it is reported.

Oklahoma Welding Equipment & Supply Co., capitalized at $10,000, has been incorporated at Tulsa, Okla., with Henry C. Carby, formerly with Welders Supply Co., Tulsa, as president and general manager. Company has leased space at 314 E. 4th Street and will represent Harris Calorific Co., Cleveland, O., with a complete line of portable generators, welding torches and other equipment.

The Strong Welding & Blacksmith Shop in Ventura, California, is adding 4,000 sq. ft., of additional space to their plant. The building which will be covered with corrugated galvanized iron, is of all arc welded structural steel construction. Trusses are of two-inch angle iron and are 48 feet in length. Mr. Strong has been in business in Ventura for 12 years and features general welding and forging. Additional equipment is anticipated for the additional working space being provided.

The San Luis Welding Works in San Luis Obispo, California, were recently opened under new management. W. Munger and F. M. Love are the new partners. Mr. Munger was until recently connected with the Union Oil Company. A new 300-amp. Hobart electric welder, which with other equipment, including a lathe, adds to the completeness of the shop.

Joseph T. Ryerson & Son, Inc., announce the appointment of E. M. Vehmeyer as manager of their Detroit plant. Mr. Vehmeyer comes to this position with a background of many years of experience in the Steel-Service business. He has been associated with the firm for over 22 years. The major portion of this time has been spent in the Sales and Service Departments. For the last two years he has held the position of Sales Manager in the Detroit plant. Mr. W. H. Basse, formerly Detroit plant manager, has been transferred to Chicago where he will engage in special sales work.

Welding with TOBIN BRONZE Saved the Cost of a new Bulldozer

Huge Bulldozer, in railway repair shop, practically as good as new after repair-welding with Tobin Bronze.

Tobin Bronze Welding reclaimed this heavy casting at a fraction of the cost of a new one. The figures tell an interesting story:

COST OF WELDING BULLDOZER FRAME

Preparation, 32 hours	$ 25.28
Welding time, 121 hours	95.59
Helpers, 22-1/2 hours	12.60
Oxygen and Acetylene (4200 cu. ft. in all)	94.35
Tobin Bronze, 375 lbs.	146.25
Flux, 2 lbs.	2.00
Charcoal, 100 lbs.	3.75
Total Cost (less overhead on labor and store charge on material)	$379.82

Full information on Tobin Bronze and other Anaconda Welding Rods is contained in Publication B-13, mailed on request.

* * *

Anaconda Welding Rods are available through leading distributors of welding equipment and supplies. For those requiring small quantities, Anaconda Welding Rods can now be obtained in clearly labeled ten-pound packages.

THE AMERICAN BRASS COMPANY

General Offices: Waterbury, Connecticut
Offices and Agencies in Principal Cities

ANACONDA
from mine to consumer

There is a suitable Anaconda Filler Rod for every bronze-welding purpose. Principal Anaconda Welding Rods, with their melting points, are listed below:

for oxy-acetylene welding

*Tobin Bronze**	*1625°F*
Manganese Bronze	*1598°F*
Brazing Metal	*1634°F*
Naval Bronze	*1625°F*
Electrolytic Copper	*1981°F*
Silicon Copper	*1981°F*
Phosphor Bronze	*1922°F*
*Everdur**	*1866°F*

for arc welding

Silicon Copper	*1981°F*
Phosphor Bronze	*1922°F*
*Everdur**	*1866°F*

**Reg. U. S. Pat. Off.*

ANACONDA WELDING RODS

Sam Newton, of Gilroy, California, has recently purchased the welding and machine shop of Frank Hardesty. New Victor gas welding equipment was recently added, and electric welding equipment is anticipated in the near future. Mr. Newton was for a number of years engaged in structural steel work in San Francisco.

At the British Empire Trade Exhibition which is due to take place at Buenos Aires from March 14th until April 27th, Murex Welding Processes, Limited, have taken sufficient space to show a number of welding plants and other products manufactured by them. The stand will make up a part of a larger exhibit displayed by their Argentine Representative, Messrs. Anderson Paterson & Co., and will include a single operator Motor Generator Set, which will be used for demonstration purposes and a Morris Petrol Driven Set. Demonstrations will be given in both Electric Arc Welding and in the Premag Process of Welding Copper.

Illinois Testing Laboratories, Inc., 141 W. Austin Avenue, Chicago, Illinois has appointed Porter Hurd, 516 Packard Building, Philadelphia, Pennsylvania, as its representative in Eastern Pennsylvania, Southern New Jersey, Delaware and Maryland for its line of Portable and Stationary Indicating Pyrometers, Resistance Thermometers and other measuring instruments for industrial purposes.

Classified Ads

Help Wanted—75c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—$1.00 per line, minimum 4 lines.
Count 8 words to line. Add 6 words for keyed address.

FOR SALE

Welding and Machine Shop—Established 11 years, only exclusive shop in growing city of 35,000 population. Owner wishes to retire. Priced at a sacrifice. Address Electric Welding Works, 16 W. Haley St., Santa Barbara, Cal.

First Class Welder—Junior designer, inspector and instructor, with own equipment, desires connection with reliable party. Have had practical and thorough experience in rebuilding aircraft, automotive, radiator and the general welding field. Member S. A. E. Address Box 406, The Welding Engineer.

POSITIONS WANTED

Position Wanted—Electrical engineer, grad., 27, single; well experienced in the development of resistance welding processes and machinery; best references. Address Box 407, The Welding Engineer.

Sales Engineer—Experience: 8 years combination welder; 6 years selling and research; graduate metallurgist. Familiar with all makes of equipment. Desire connection with reliable organization. Highest recommendation. E. A. Hunt, 3021 Commonwealth Ave., Alhambra, Cal.

Wanted—Permanent job as electric and acetylene welder. Eight years railroad boiler and machine shop, four years automobile plant experience. Fred Blaes, 2731 Montana, Louisville, Ky.

Electric Welder—Eleven years' experience on all classes work; desire permanent position; preferably where one welder is kept to take full charge. Address "Welder," 76 Fowler St., Port Jervis, N. J.

Expert Welder—On both arc and acetylene, seeks position as welder or foreman. Fifteen years' experience on all classes of work. Address A. M. Blakey, 123 Sixth St., Turtle Creek, Pa.

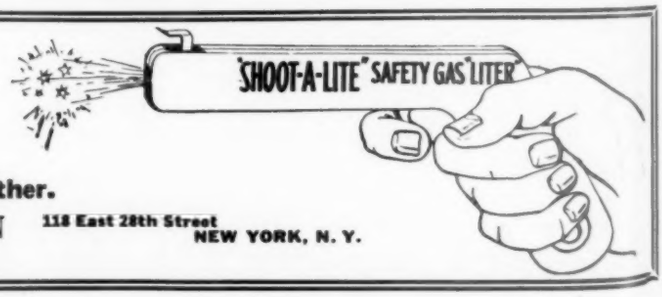
Electric Welder—First class, desires position in structural shop. Married, willing to travel. Worked on So. Cal. Edison Bldg., Dallas P. & L. Bldg. Best references. Address Box 405 c/o The Welding Engineer.

GUARANTEED
REBUILT ELECTRIC ARC WELDERS
SERVICE COMPANY
3741 Cedar Ave. Cleveland, Ohio

UNDER-WATER METAL CUTTING CORPORATION
Complete apparatus and skilled diver operators for cutting steel plate, sheet piling, cast iron or any metal under water.
c/o MERRITT-CHAPMAN & SCOTT
17 Battery Place - New York, N. Y.

SPECIAL OFFER
Limited Quantity Only of
LARGE DOUBLE TANK TRUCKS
All welded steel construction, 14" wheels. Capable of holding one large 220 cubic foot oxygen cylinder and one W K POL cylinder. $15.00 value—NOW
$7.85
F. O. B. Cleveland
Mail all orders to
BURDETT OXYGEN CO., Cleveland, Ohio

The Practical Lighter
FOR WELDING TORCHES.
SHOOTS STRAIGHT TO THE SPOT.
CONVENIENT TO HANDLE.
NO BURNING OF HANDS.
Each Sale Brings Another.
SHOOT-A-LITE CORPORATION
118 East 28th Street NEW YORK, N. Y.
Ask Your Jobber or Write Us



The Standard Specification of the Welder *and* Cutter

The name "Commercial" has been associated with dissolved acetylene since the beginning of oxy-acetylene welding.

"Commercial" is known for its RELIABILITY, UNIFORMITY, PURITY, and its ORGANIZATION for service to the industry.

Whatever your gas requirements, you should know about our sales plan. Ask our nearest office to tell you about it.

Supplied in the following size cylinders:

10x30 in. size—125 cu. ft. cap.
12x36 in. size—225 cu. ft. cap.
12x44 in. size—275 cu. ft. cap.

Commercial Acetylene Supply Co., Inc.

General office: 40 Rector St.
NEW YORK CITY

Branches:
600 W. Jackson Blvd., Chicago, Ill.
683 Atlantic Ave., Boston, Mass.
680 Hamilton Ave., S. E. Atlanta, Ga.

We also sell
OXYGEN
and a complete line of
APPARATUS
and
SUPPLIES

TRADE COMMERCIAL ACETYLENE MARK

Ryerson Welding Equipment

Wilson Arc Welders Model S 200 Amp. Portable Type

Includes Arc Welders, Spot and Butt Welders, Electric Flue Welders, Acetylene Welders, Welding Rod and all Accessories

Offering a complete sales and engineering service available from 20 offices. Also the advantage of 86 years of Ryerson experience in the metal working fields. Tell us your welding problems—our engineers are always ready to help solve them.

JOSEPH T. RYERSON & SON INC.

Chicago Cincinnati Milwaukee Cleveland Minneapolis Detroit Duluth Buffalo Denver Pittsburgh Los Angeles Philadelphia San Francisco Richmond Houston Boston Tulsa Jersey City St. Louis New York

USE THIS COUPON

JOSEPH T. RYERSON & SON, INC.
Lock Box U, Chicago, Ill.

I am interested in the items checked. Send literature and complete information.

Welders
☐ Arc ☐ Butt
☐ Spot ☐ Acetylene
☐ Electric ☐ Flue
☐ Welding Rod ☐ Accessories

Name .....
Firm .....
Address .....
City .....

NATIONAL (TRADE MARK) CARBIDE

Quality Coke
Plus
Quality Limestone
Plus
Engineering Ability
Equal

National Carbide

National Carbide Sales Corporation
Lincoln Building **New York**

Crown Boiler Fix is a metallic powder with an aluminum base and is used by thousands of master plumbers and welding shops with great success for repairing steam and hot-water boilers. This compound is entirely different and far superior to any boiler compound on the market.

Crown Boiler Fix is applied by simply mixing contents of can with two quarts of water and pouring into boiler.

The unusual and superior feature is that after being poured into boiler and repair is completed the compound never becomes harder than tar, thereby overcoming the most severe trouble encountered in boiler repair, that of expansion and contraction, as Crown Boiler Fix, acting like tar, will expand and contract under all adverse conditions. After electric welding a boiler, a can of Crown Boiler Fix will make the weld absolutely water-tight and will permanently repair all cracks that are impossible for the welder to reach.

Crown Boiler Fix does not discolor the water.

Price, $8 per can, less 50% and 10%.
One can free with every six.

Crown Radiator Fix makes electric welds on cast iron permanently water tight; also repairs cracked water jackets, motor heads, leaky radiators, etc.

Crown Radiator Fix is different from any other compound on the market. It is a metallic powder containing a quantity of crushed aluminum.

Crown Radiator Fix is absolutely guaranteed not to clog radiator as it only congeals when in contact with air.

Immediately after being poured into radiator, the compound circulates through the entire water system and starts to work.

As the water leaks through the cracks and porous parts it carries with it the Crown Radiator Fix, which instantly upon coming into contact with the air, congeals and forms a permanent metallic repair.

Price, $12 per doz., less 50%. Prices on larger quantities on application.

Crown All-Metal Filler is a mineral composition that repairs cracked waterjackets, motorheads, waterpumps, porous castings, etc., by simply heating the casting to 400° heat and rubbing on the Crown All-Metal Filler, which will penetrate to the underside and rust up and make a guaranteed, permanent repair. Can be made to flow up, down or sideways. Being gray in color, it blends with cast iron and steel, although it can be used on all metals.

SPECIAL FOR ELECTRIC WELDERS

Crown All-Metal Filler is the only compound that will make an electric weld on cast iron absolutely watertight. It penetrates through the smallest pin-hole where it is possible for water to leak out, and the filler will rust, which is necessary for a permanent repair.

Standard size pound box, $4.50.

DOUBLE CROWN PROCESS

For a Permanent Watertight Weld on Cast Iron Waterjackets

Electric Welders are now able to weld waterjackets satisfactorily without dismantling motor by the DOUBLE CROWN PROCESS

Crown Radiator Fix is a metallic powder with an aluminum base which is poured into radiator. It immediately floats through the entire water system and seals all leaks from a pinhole to a seven inch crack. As the water leaks out of the porous parts or cracks, it carries with it the Crown Radiator Fix which congeals instantly upon coming into contact with air, thereby making the weld watertight.

On extreme porous welds, due in most cases to a poor grade of cast iron, we recommend applying Crown All-Metal Filler on outside and Crown Radiator Fix on the inside. By this method you are checking leaks from both sides. In the event that a hair crack is overlooked or develops after making the weld, we absolutely guarantee that Crown Radiator Fix will seal it. For a few cents additional, apply a small quantity of Crown Radiator Fix after welding, to assure a permanent watertight weld.

Manufacturers and Sole Distributors

CROWN ALUMINUM SOLDER CO., Inc.
881 EAST 134th STREET -:- NEW YORK, N. Y.

This New Chart Tells The Uses of...

"KORO"
PATENTS APPLIED FOR

Welding Wires

Whether you have one or many welding problems, there's an electrode in the "KORO" line of welding wires to fit your requirements.

Ask for a copy of this valuable chart. IT IS FREE.

KORO CORPORATION
3021 Madison Street
BELLWOOD, ILLINOIS

YOU CAN DO IT BETTER WITH TORCHWELD

After all the only claims that mean anything are those based on actual performance, economy and safety in operation.

Welding and cutting of metal must be done with torches and regulators and if these torches and regulators fail, production fails.

Some torches and regulators are tolerated. Torchweld equipment assures greater production with less operating cost.

For quality welds and cleaner cuts in quantity use Torchweld.

FOR

RELIABILITY

USE

Non-Flash Equipment

"BUILT TO STAND THE ABUSE OF CONSTANT USE"

Write for Catalog No. 29E and ask us for the name of our nearest Distributor to you.

TORCHWELD EQUIPMENT COMPANY, 224 N. Carpenter St., Chicago, Illinois

K IN G OF THEM ALL

A War-Time Cutting Torch That Still Outworks Other Torches

This is the K-G Style "M" Cutting Torch, with Monel metal head and lock nut. Tips can be furnished for use with any cutting gas. K-G tips give greater concentration of preheating flame. Torch can be made any length desired. Standard length, 20 inches.

ANOTHER old-timer in the K-G ranks heard from. A K-G cutting torch was sold to the Newburg Shipbuilding Company during the war. After the armistice, it was sold to a firm who had contracted to cut up old gun boats. That job done, it was bought by a large junk yard, where it put in a few more years of hard service.

Then came a real test. A safe and vault were being dismantled, and none of the torches being used proved equal to the job. Someone suggested a K-G, and this torch was put to work and finished the job without complaint. Its new owner tells us it is not for sale because he never knows when he will have another tough job to do.

K-G WELDING & CUTTING CO.

515 West 29th St., New York City

Phone Chickering 0996-7-8

The following K-G dealers are ready to take care of your apparatus requirements promptly:

WELDERS SERVICE CO., 229 2nd Ave., Pittsburgh, Pa.
WELDERS SUPPLY CO., 700 McCulloh St., Baltimore, Md.
H. H. KRESS, 1718 Sansom St., Philadelphia, Pa.
HARRY P. WINSLOW, 35 Vinton St., Worcester, Mass.
CENTRAL OHIO WELDING CO., 253 E. Spring St., Corn. Neilston, Columbus, Ohio
PASSAIC-BERGEN WELDING WORKS, 650 Main Ave., Clifton, N. J.
SUTTON-GARTEN CO., 217 W. 10th St., Indianapolis, Ind.
AM. COMPOUND CO., 233 Congress St., Boston, Mass.
WELDING & SUPPLIES CO., 3445 Parthenais St., Montreal, Canada
CHICAGO GRINDING & MACHINE CO., 2117 Tilden St., Chicago, Ill.
SIGHT FEED GENERATOR CO., W. Alexandria, Ohio
CHAS. E. EBRIGHT, 2642 Terrace Ave., Columbus, Ohio
FRANK MILLNER COMPANY, 102 N. Olden Ave., Trenton, N. J.
SPRAGUE SERVICE & SUPPLY CO., 276 Davidson Ave., Perth Amboy, N. J.
STORTS WELDING COMPANY 44 S. Colony St., Meriden, Conn.
WILLIAM McCARTHY, 308 James St., Syracuse, N. Y.
GEO. E. TEMPLE COMPANY, 396 Main St., New Rochelle, N. Y.
JOHN W. EVANS, 95 Brook St., Tompkinsville, S. I.

THE KELLERFLEX

KWE

The Kellerflex machine with low roller floor stand has four speeds which provide for operating various tools at their correct speed. The whole unit swings freely both horizontally and vertically, adjusting itself instantly to the position in which the end piece is held.

This feature reduces the strain on the cable and also saves any loss of power from friction due to driving a shaft through sharp curves.

This machine is particularly recommended for grinding, snagging, wire-brushing, sawing, etc.

Let us send you our catalog and recommendations both for machine and attachments as adapted to your individual needs.

KELLER MECHANICAL ENGINEERING CORPORATION
72 Front Street Brooklyn, N. Y.
Complete stock at Chicago and Brooklyn.

Big Jim (Master Welder) says:

One of the many reasons Fre-Flo and Atco welding rods are used by the best welders is because they comply with the American Welding Society requirement as well as the U. S. Government and railroad specifications. They will save you money and make the best welds for you too—try 'em.

Ask for a free sample of FRE-FLO to try in your shop.

Big Jim (MASTER WELDER)

ATLAS PRODUCTS ASSOCIATION

Our Rods are sold only through distributors. A few desirable territories are still open. Correspondence from distributors is invited.

THE ATLAS FOUNDRY COMPANY
W. 69th & W. & L. E. Ry., Cleveland, Ohio

For Safe Economical Shipment of Acetylene Gas

Hackney Acetylene Cylinders are designed to deliver acetylene gas safely and economically to the customer.

This is the kind of service which has made Hackney cylinders lead their field for more than twenty years.

Write for complete information that proves Hackney's dependability and low costs.

PRESSED STEEL TANK COMPANY
MILWAUKEE, WISCONSIN

1125 Continental Bank Building, Chicago
1301 Vanderbilt Concourse Building, New York
5701 Greenfield Avenue, Milwaukee, Wisconsin
463 Roosevelt Building, Los Angeles, California

Hackney
MILWAUKEE

A BETTER ROD *for* EVERY WELDING ROD REQUIREMENT AND AN ELECTRODE HOLDER

WHICH WILL SOON PAY FOR ITSELF

The Users of Stoody Products Are Always Happy

Stoody Products were designed and are manufactured by experienced welders for welders, and each is a leader in its field.

Standardize on Stoody Products

and be sure of using the best product for any purpose.

Manufactured by

STOODY COMPANY

Whittier • California

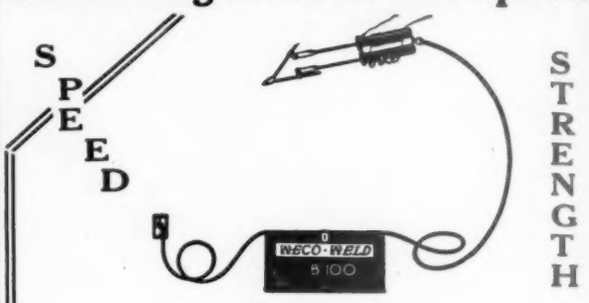
You can't make a Silk Purse from a Sow's Ear

A weld is no better than the rod that makes it. Only when the rod flows evenly, does not sputter or become porous do you get a strong homogeneous weld. Wissco rods have these characteristics. Furthermore, they run uniform. The Wissco rods you bought for your last job can always be duplicated exactly.

WICKWIRE SPENCER STEEL CO.
41 East 42nd Street, New York City
Buffalo Chicago Cleveland Philadelphia
Detroit Tulsa Worcester
Pacific Coast Headquarters: San Francisco
Branches and Warehouses:
Los Angeles Portland Seattle

WISSCO
WELDING RODS

WELDING ALUMINUM
Sheet and Cast
Increasing Production Speeds



Weco-Weld

CAN YOU

run an unsupported butt weld on thin sheet aluminum and get a perfect ripple weld on both sides with one application of heat at production speed?

Upon Request

YOU CAN

weld aluminum the difficult way with the Electric Torch which produces the only source of welding heat that gives a smooth non-oxidizing flame for this type of work.

Warner Engineering Corporation
Cable: WECO **Pomona, Calif.**

Grind Welds in Alleghany Metal

with
HASKINS EQUIPMENT

EASILY AND PROFITABLY

Because of the newness of Alleghany metal many plants have not perfected their welding operations. The unthought hardness of the weld and the very noticeable hardening of the metal at the weld when over-worked are problems that Haskins has worked out. Let us send you information on grinding welds in Alleghany metal as well as other grinding operations.

WRITE FOR OUR 48-PAGE CATALOG

R.G. HASKINS COMPANY
Portable Flexible Shaft Machinery
4639 W. Fulton St., Chicago, Ill.
BRANCH OFFICES IN PRINCIPAL CITIES

HASKINS PORTABLE FLEXIBLE SHAFT MACHINERY

Steel Sales

WELDING ROD SERVICE

LARGE CHICAGO STOCKS

Whatever your requirement may be in Welding Rods—gas; metallic, carbon or automatic arc—you may get what you need from our large Chicago stocks and GET IT QUICKLY. These widely assorted stocks and our quick shipments are your insurance in time of emergency. The suggestions of our experienced welding engineers are yours for the asking.

A Rod for Every Job in Gas and Electric Welding

Our principal kinds of Welding Rods are:

WILSON COLORTIPT
NORWELD SPECIAL
NORWELD
FLINTWELD
S.S. HIGH STRENGTH

S.S. MEDIUM CARBON
CASTWELD
BRONZEWELD
HICARWELD

HIGH MANGANESE
NICKELWELD
ELECWELD SPECIAL No. 6
SILVER SOLDERS

ELECWELD Nos. 10 and 18
S.S. PROCESSED
STEELWELD
VANADWELD
ALUMINUM

J. A. Roesch, Jr., Pres.
F. W. Walters, V. Pres.
D. R. Hoffman, Sec. Treas.

STEEL SALES CORPORATION

129 South Jefferson Street
Chicago, Ill. Franklin 4280

STEEL—MONEL METAL—NICKEL—BRASS—COPPER—COPPERWELD—NICKEL SILVER—PHOSPHOR BRONZE—ALUMINUM—ZINC

50 to 200 ampere. Type C.,
110, 220, 440, 550 volt.

OWEN INDUCTION ARC WELDER

Weight 355 lbs.

This machine will produce more lineal feet of weld per hour, per day, per year than any other machine of similar capacity built. IT WELDS CAST IRON AND MALLEABLE IRON. You do not have to use steel studs to form a welding surface.

The Owen is the simplest and most inexpensive method of Welding known to Science.

No moving parts to wear and replace; no bearings to oil, or burn out; no commutator trouble; no brushes; no gas tanks to bother with; no shut downs; no lost time.

YOU WILL EVENTUALLY STANDARDIZE on OWEN INDUCTION ARC WELDERS—WHY NOT NOW?

For further information write

Owen Electric Manufacturing Company
Fayetteville, North Carolina
(*Exclusive manufacturers of OWEN Patented arc welding machines*)

Our Trade Mark *is your* Guarantee *of* Quality

A new cast iron brazing flux that anyone can use—Metal-Bond Special No. 31 Cast Iron Brazing Flux, for malleable and cast iron.

This flux has been subjected to severe tests by many commercial welders, as well as by our own welders, before it was offered to the trade. In 98 percent of the tests made we were advised that this flux was everything that could be desired. Surprise and delight were expressed with the way it worked and with the tests made on the finished job. In several cases welders reported that it could be used UNDER ANY HEAT and the following points were brought out:

Removes oxides produced under brazing heat; flows freely; cleans fast; carries your brazing metal right into the pores of the iron; brazing metal flows freely into place and can not be chiseled off. It gives you a perfect braze, leaving a clean job, easily machined and finished. Any welder can use it.

Packed in one-pound square cans at $2.00 each. Send for a can today. Like all Metal-Bond Products, it is sold under our "Money Back Guarantee." Write for a Metal-Bond Products Catalog. It contains information of value on welding and soldering materials.

METAL-BOND MANUFACTURING CO.
Manufacturers and Distributors
4211 North Broadway St. Louis, Mo.

FOR SPEED AND SERVICE

A production welder with motor drive that guarantees speed and accuracy and consequently increased output at less cost! Special transformer, adjustable horns and treadle, 8-step regulator, one piece base. Sizes—6-inch to 30-inch overhangs—13 to 35 KVA.

Let a T-W Weldineer help solve your problems.

TAYLOR-WINFIELD WELDERS

The TAYLOR-WINFIELD Corp.
WARREN, OHIO • *Offices in Principal Cities*

ELECTRIC and GAS WELDING WIRE

Immediate Shipment from Warehouse

For Every Purpose

Williams' three conveniently located warehouses have at all times a complete stock of Williams and Wilson Welding Wires for quick delivery. Stock includes Williams "Norflo", "Weldflo" and "Weldflo" Sulcoat, Wilson "Color-Tipt," Phosphor Bronze, Brass Rod, Nickel Steel, Cast Aluminum and others. Free samples gladly furnished. Guaranteed analysis—absolute uniformity. Ask for price list and catalog.

WELDING SUPPLIES

Representing:
TORCHWELD EQUIPMENT CO.

Coated and Uncoated

WILLIAMS & COMPANY, Inc.

901-937 Pennsylvania Ave., N.S.,
PITTSBURGH, PA.

Cleveland—1748-56 E. 22nd St.
Cincinnati—2118-26 Spring Grove Ave.

THESE HOLDERS are now standard equipment with many concerns.

EUREKA Metallic Electrode Holder
GREAT STRENGTH, LIGHT WEIGHT, AMPLE CURRENT CAPACITY. NO SPRINGS.

WELDING HELMETS
and
HAND SHIELDS
OF CORRECT DESIGN

VULCAN Carbon Electrode Holder
With *and* Without WATER COOLING

Pioneers, Designers and Manufacturers

The Fibre-Metal Products Co.
Chester, Penna.
DISTRIBUTORS WANTED

There's No Waste Motion Here

YOU can undoubtedly reach a large number of good firms through an advertising campaign, which is concentrated in papers reaching selected industries, and reach along with them thousands of readers who are not and never will be concerned with welding—that's waste. You pay a needlessly high price for the interest that's there, and you make a decidedly less effective impression on that interest than if you used a less expensive campaign in **The Welding Engineer**, which reaches the concentrated interest of the country. In these pages you talk to the **right man**, in the **right plant**, at the **right time**. That's efficiency.

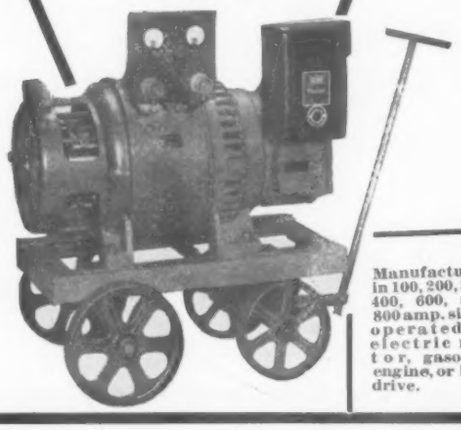
The Welding Engineer 608 S. Dearborn St., Chicago

HANSEN-ARC-WELDERS

. . . incorporate features that are found only in Hansens—single current control, internal stabilizer, self excitation, automatic voltage control. They make possible a compact, sturdy unit with a minimum of moving, wearable parts.

A Hansen on your job will make better welds, work faster and cut costs.

NORTHWESTERN MFG. CO.
Milwaukee, Wisconsin



Manufactured in 100, 200, 300, 400, 600, and 800 amp. sizes, operated by electric motor, gasoline engine, or belt drive.

Imperial

TYPE M
ACETYLENE GENERATORS

Portability with Economy

can be realized with the Imperial Type M Acetylene Generator wherever oxy-acetylene welding equipment is used.

It has the preference in pipe line field work where maximum portability is required.

In addition to the portability, think of making a saving of from two to four cents per cubic foot over the cost of gas compressed in cylinders and having a purer gas and a constant supply on hand. Carried in 50 and 130 pound sizes.

Write for free generator booklet

THE IMPERIAL BRASS MANUFACTURING CO.
522 South Racine Avenue, Chicago, Illinois

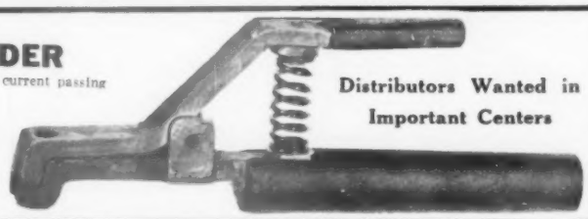
Look at it any way you like — SHAWINIGAN CARBIDE gives "More Gas per Pound"—

SHAWINIGAN PRODUCTS CORPORATION · NEW YORK · *Plants: Shawinigan Falls, Quebec · · Keokuk, Iowa · · Anniston, Ala.*

End troubles by using
FORT PITT METALLIC ELECTRODE HOLDER

Tried and proven by large users. **Spring cannot lose tension as it is absolutely insulated.** No current passing through spring.
Each of six perfect positions to grip electrodes, insuring rigid and positive contact.
Lever has a protective rubber covering. Body and jaw of steel; copper shunt and terminal, insuring ample current capacity to electrode. **No overheating.**
Size No. 1 for electrodes from ¼-in. or larger. Price.....$5.50
Size No. 2 for electrodes from ⅛-in. to ¼ in., inclusive. Price..... 5.00
NO REPLACEMENT PARTS TO BUY.

F. R. FAULK Equipment Sales 50 Penn Ave. Pittsburgh, Pa.



Distributors Wanted in Important Centers

Quasi-Arc

Covered Welding Rods

UNEQUALED for boiler welding or other work subject to stresses at high temperatures and for joints requiring high resistance to shock and fatigue caused by alternating stresses. Quasi-Arc welds also successfully resist corrosion. Write for technical folders describing the unique features of Quasi-Arc rods.

For Better Welds

QUASI-ARC, Incorporated, 11 W. 42nd St., New York
Representatives in 27 World's largest Industrial Centers

ATTENTION!
OIL WELL DRILLING MEN:

DIG MORE HOLE AT LOWER COST —By using
Superior Inserts and Compound Metals
Assure best results. Write for prices.
SUPERIOR ALLOYS Corp., Ltd. Box 174, Los Nietos, Cal.

Read Pages 169-173

In the 7th Edition

"Welding Encyclopedia"

It is one of the most instructive and practical articles available on

Silver Solders and Silver Brazing

All the more important just now, because the present low price of silver makes Silver Solders practical for low-cost quantity-production.

HANDY & HARMAN
57 William St., New York City

REGO THOMAS TORCH
for General Welding *and* Cutting

Develops exceptionally *long*, "fast" flame, is economical and operates at any combination of pressures. Will not flash back.

An amazingly light weight torch. Cutting attachment available for converting quickly into cutting torch.

A trial will prove its performance. Details on request.

THE BASTIAN-BLESSING CO.
246 E. ONTARIO ST. CHICAGO, ILL.

Agnew Electric Welder Co.
MILFORD, MICHIGAN

SPOT, BUTT OR SPECIAL WELDERS

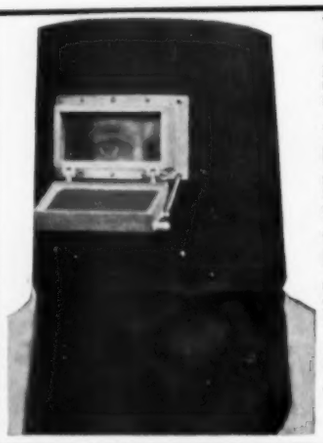
Automatic or Manual Operated

YOU Can Do Jobs Like This—
With the TORIT Kerosene Preheater 8-K

Put the broken parts in place, then preheat, and a good job of welding is assured.

Send for bulletin on TORIT Preheaters

St. Paul Welding & Mfg. Co.
170 W. 3rd St., St. Paul, Minn., U. S. A.



THE IDEAL HELMET FOR WELDING
protects the head, chest and neck from direct and reflected rays.

THE HELMET WITH A DOOR,
gives convenience for quick inspection of the work and assures protection for the eyes.

THE IDEAL SHIELDS, HAND TYPE
are strong and light and are easily held without tiring the hand.

IDEAL LENSES FOR EITHER LIGHT OR HEAVY WELDING

The Ideal Face Shield Company
408 N. GARFIELD AVE.,
Columbus, Ohio

1905 **Strand** 1931

FLEXIBLE SHAFT EQUIPMENTS

½ H. P. DIRECT OR THREE-SPEED DRIVE ½ H. P.

You can get real action with these husky machines in weld grinding.

We also build other types ⅛ to 2 H.P. capacity.

Tone up your welding shop with "STRAND" machines.

Manufactured by
N. A. STRAND & CO.
5001-5009 No. Lincoln Street, Chicago

Anti-Borax WELDING FLUX

"ANTI-BORAX"
Oxy-Acetylene Fluxes
are made for every metal and have EXCEPTIONAL merit.

BRAZ-CAST FLUX
For bronze welding of Cast Iron.

We also make the popular "E-Z" Welding Compound for forge welding.
Samples of any upon request.

Anti-Borax Compound Co., Ft. Wayne, Ind.

Arc Welding Equipment

Motor, Gasoline Engine, or Belt Driven Arc Welding Generators

Transformer Arc Welders

Arc Welding Accessories

Allan Manufacturing & Welding Co., Inc.
726 Washington Street BUFFALO, NEW YORK

STATE OF OHIO:
F. C. Geraghty & Co., Union Bldg., Cleveland, O.

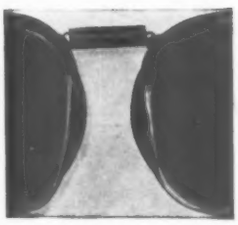
DETROIT & NORTH MICHIGAN:
Welding Metals Mfg. Co., 122 Larned St., East, Detroit, Mich.

With This New Goggle

the hazards of welding are reduced to a minimum

The Willson BULL DOG

Trade Mark Reg. U. S. Patent Office



A distinctively new shape designed and furnished only by Willson. Right and left cups with broad, bearing surfaces that assure proper fit and maximum comfort.

To adjust chain bridge to the proper width, loosen the screw caps slightly, and slide the anchors to which the chain is fastened to the desired position. Tighten screw caps and the adjustment is complete. This eliminates constant chain twisting.

For Welders

Those industries who are looking forward to improved eye accident records, will see in this new Willson goggle a great aid towards such an accomplishment.

THE DETAILS

A new shape of cup. So new—so different—yet so comfortable and close fitting it will remove much of the "goggle prejudice."

A new type of bridge. A simple adjustment that permits an exacting and permanent bridge width without the constant twisting of an unruly chain.

Ventilation. This patented port permits a generous flow of air into the cup, but excludes stray light and incandescent sparks.

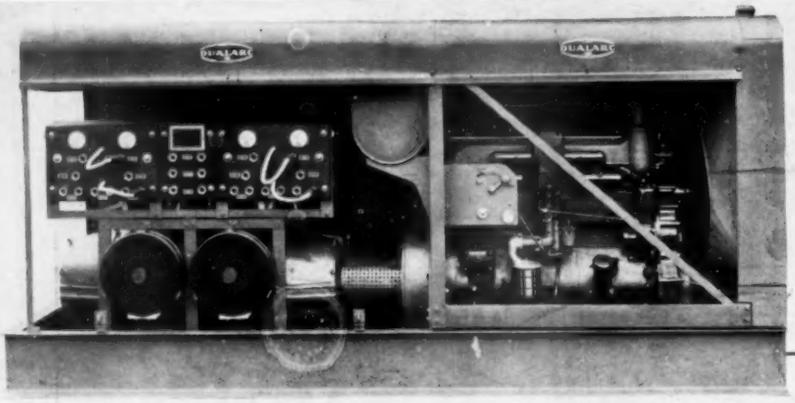
Fifty millimeter lenses of Willson-Weld glass with clear cover glass. Willson-Weld glass reduces to a minimum the hazard of dangerous light rays in any welding operation.

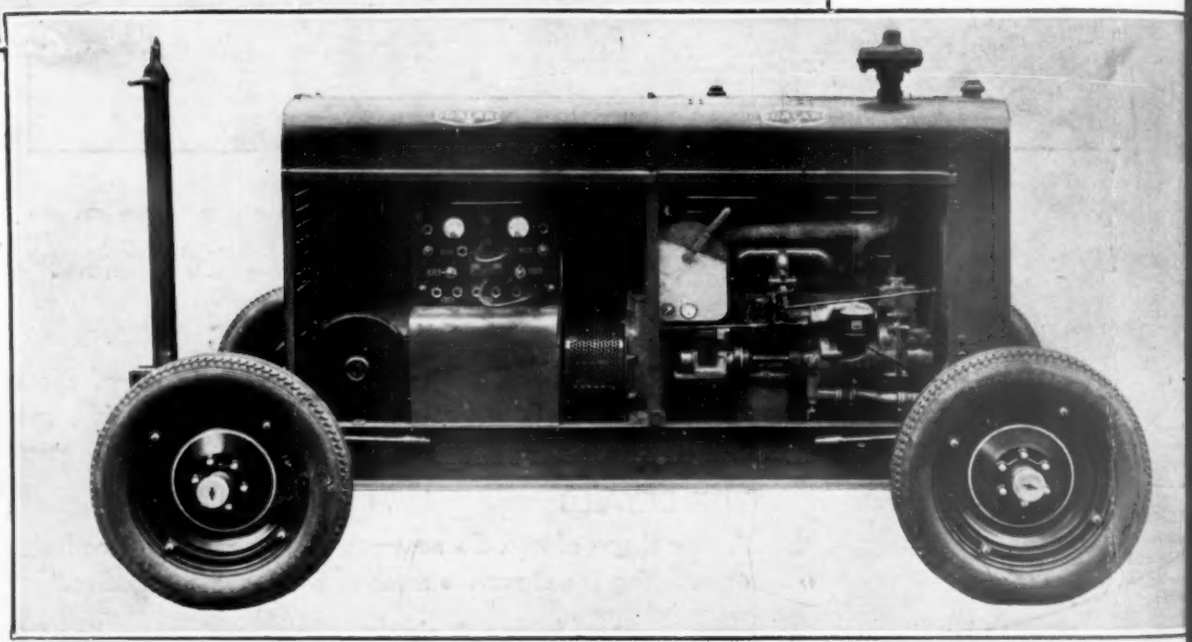
Price: $2.75 per pair, f. o. b. shipping point. The Willson Bull Dog for chippers lists at $2.00 per pair f. o. b. shipping point.

For full detailed description, write to:

WILLSON PRODUCTS, Inc.
READING, PENNSYLVANIA, U. S. A.

There Is Only One Generator to Consider If You Want—*Lights—Drills—Grinders—Independent of The Welding...*





There Is Only One Arc Welder To Buy If You Want AC *as well as DC* for the Semi-Arc Flash Welding Process—Spot Welding—Etc., ...

Both of the above features are covered by patents issued to C. J. Holslag and no one has as yet infringed them.

The DUALARC Welder combines all the welding possibilities of other arc welders in one machine. It has compound field for carbon arc, shielded arc and distant welding; differential field for metallic arc, thin work and aluminum; and it has independent control of amperage and voltage.

Our two-arc generator set can be multipled.

ELECTRIC ARC CUTTING & WELDING CO.

152-156 Jelliff Ave., NEWARK, NEW JERSEY